Dr Engelmann

LIV.

VOL. VIII. SEPTEMBER, 1852. NO. 6.

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## PUBLIC POLICY,

AND

## POLITE LITERATURE.

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THE

# WESTERN JOURNAL

AND

## Civilian.

M. TARVER & H. COBB, Editors and Proprietors.

VOL. VIII. SEPTEMBER, 1852. NO. 6.

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THE

# WESTERN JOURNAL

## and Civilian.

VOL. VIII. September, 1852. No. VI.

ARTICLE I.

## Knowledge, the Source of Happiness.

"WHAT IS TRUTH?"

Having recently discussed the relation between ignorance and crime, and shown by facts which we deem sufficient to convince the unprejudiced reader that the former is the principal cause of the latter,* we now propose to inquire how far the happiness of individuals is affected by this fruitful source of evil. It requires but little intelligence to comprehend the nature of the penalties annexed to the transgression of human laws. The prison, the instruments of punishment, and the place of execution, are palpable objects; and their relation to disobedience of legal enactments is obvious to all. But the penalties consequent upon the nonobservance of the laws of our individual existence, as intelligent and moral beings, though not less certain than the fiat of Deity, are perceived and appreciated by none but the truly wise. The laws of physical health and of moral enjoyments are stamped upon man's nature, engraved upon his heart, and continually proclaim his duty to himself; yet, he comprehends them not, or comprehending neglects to obey, because judgment is not executed speedily upon the disobedient.

Ignorance of these laws, and of the relations between cause and effect exposes the human family to disease in a thousand forms which cut off the larger portion of the race before they arrive at that period when man is most useful to himself and to his species. Those who fall are borne to their resting places, and the survivors, nothing profiting by their untimely removal, continue to live on in disobedience,

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NOTE.—Lest we should weary our readers with subjects relating to the practical economy of the country, we have, for the sake of variety, selected a chapter from our manuscripts, written some years ago, which we have changed in some respects with a view to its application to certain subjects now claiming the attention of the public.—*Senior Editor.*

* Vide page 297.

until they likewise suffer the penalty of violated laws, and fall, the victims of ignorance.

Hence, also, the prejudices which forestal reason, and stultify the judgment; hence vain and vicious desires which conflict with the social welfare, making man the adversary of his brother, and filling his heart with distrust and inquietude. And hence superstition and fanaticism, those awful scourges of the race, which rob humanity of its highest and holiest attributes, sending man forth, possessed with the qualities of a fiend, to deluge the earth with blood.

But it is objected by some that education does not protect mankind against these and other evils of like nature, and when we have appealed to individuals for their countenance and support in behalf of a system of public instruction, they have pointed to the vices of the learned, and contrasting them with the virtues of the ignorant, declare their conviction that education is a source of corruption rather than of improvement. And although we cannot admit the truth of this conclusion, yet we have cause to regret that men do not advance in wisdom and virtue in a degree commensurate with their opportunities for the attainment of knowledge. That such is the fact, cannot be denied. But it is not because they are incapable of advancement in virtue, and in that knowledge which enlarges their capacity for moral enjoyments. The fault is in a defective system of instruction which, looking chiefly to the cultivation of the intellect, by exercising the mind in the study of physical science and abstract doctrines in morals and religion, neglects the improvement of the moral nature—the test of truth and the source of human wisdom.

Without calling in question the truth of doctrines taught in the schools, it may be affirmed that the mode of instruction does not present the individual man, and the relations which he sustains to society and to the author of his being, in a light calculated to afford comprehensive and consistent views to the mind of the student.

The desire for knowledge is a property of man's nature, but owing to the limited range of individual observation, much the greater part of that which is attainable in early life is acquired through the report of others; and regarding these reports as truths, he adopts them as the basis of his reasoning, and though subsequent observation may cause him to doubt, yet few possess the courage or industry to investigate the truth of that which was taught them in the days of their youth. And thus error is transmitted from one generation to another until it claims the sanction and reverence of mankind upon the ground of its antiquity.

*Truth is an attribute of speech, and consists in a right conception of facts and principles correctly conveyed by one individual to the un-*

*derstanding of another.* But when we reflect on the fallible nature of the mediums through which it is transmitted, we are admonished of the danger of placing implicit confidence in the observations and report of others, and hence it is the duty of all men to investigate for themselves whatsoever relates to their own well-being.

It is worthy of observation that, in an age when physical science which is based upon uniform and permanent laws, is steadily and rapidly progressing, the science of morals should remain stationary, and in some respects, even exhibit signs of decay. Accustomed to the demonstration of physical laws and the properties of matter, one might suppose that men would be led into a closer investigation of those principles which affect their individual happiness as intellectual and moral beings. In pursuing this investigation, they would find the facts as well authenticated, and the laws to which they relate as obvious and not less uniform and permanent than those relating to physical science. Nor are the tests of truth in this case less certain than those which demonstrate the laws of matter. Neither is man indifferent to this subject; for the desire of happiness is an inherent property of his nature continually prompting him to action, and when disappointed in the pursuit, and even when despairing of its attainment, the desire remains unabated, and only ceases when the mental faculties fail to perform their functions. Why, then, do mankind remain in ignorance of those laws, the observance whereof is essential to the attainment of happiness? This is a great moral problem, and were we to hazard an answer, we should say that it was owing to the want of proper instruction.

Man was endowed by the Creator with two natures whose instincts and desires are opposed to each other, and yet, under the guidance of reason, they are made to operate conjointly in promoting the well-being and happiness of the individual. Self-preservation is the first law of nature, and in conformity with this principle it is just that the wants of the individual should be supplied before administering to the necessities of others. But man cannot live alone and perpetuate his race; and hence the social or moral principle inclines him to devote a reasonable portion of his time and means to social purposes.

The desires springing from these respective natures, though true to their objects, were not designed, except in cases of emergency, as guides of human conduct. Both are subject to the control of reason which sits in judgment upon their respective demands, and decides according to the lights which it has received through the medium of the senses. Though in other respects antagonistic, yet the desire of happiness is common to both natures, and it would be unphilosophical to affirm that the judgment would not, in all cases, conform to the best

interests of the individual, provided all the facts touching the subject under consideration, were known and properly considered. And, the will being subject to the judgment, the actions of men would conform to the laws of their being, and harmony, social love and divine adoration would reign throughout the earth.

But where, in the process of reasoning, important facts—as a law of nature—relating to the subject under consideration are unknown, or, if facts be assumed which have no existence, the judgment must be erroneous, and the action which proceeds from it detrimental to both individual and social happiness. There is less danger of being misled by reasoning from a few facts, well understood, in cases where others relating to the subject are totally unknown, than from an unwarrantable assumption of facts which do not exist. And upon investigation, it will be found that the greater part of the evils which afflict mankind, may be traced to a misconception or an unwarrantable assumption of facts in the process of reasoning. We need only look into the street, and take the first individual that meets the eye, as an instance. There goes a man who is compelled to labor for the subsistence of himself and family. Enter into conversation with him, and you will discover that he regards labor as a curse imposed upon the human family; he has arrived at the conclusion that a majority of mankind regard wealth as the test of respectability; he believes that he is degraded by his condition in the estimation of the community in which he lives, and that wealth, no matter how obtained, would make him respectable and happy. Miserable man! laboring, as he deems, under a curse imposed by the Creator, and contemned, as he supposes, by men, how is it possible that he can love the former, or sympathize with the latter? It is scarcely necessary to observe that his conclusions are drawn from an unwarrantable assumption of facts, and that a large part of the human family reason from the same premises. Volumes might be filled with a bare recital of the evils which flow from the shortsighted and false views of the economy of man's physical and moral nature; but we leave to the reader the task of tracing them out for himself. Again, there goes an individual who has separated himself from the world, and become a member of a church, by the rules whereof he is restrained from indulging in certain vices that are supposed to be tolerated by the community at large. He talks of the sacrifices that he has made to the cause of religion; believes himself despised and persecuted, and deems it his duty to despise what he calls wordly objects, lest they should take too strong a hold upon his affections. Deluded man! How can he enjoy the comforts of religion, so long as he regards the vices of bad men as

sources of pleasure, or how can he adore the Creator with all his heart, while he contemns a part of his works?

The laws impressed by the Creator in the beginning upon all his works must remain unchanged forever; and it would be calling in question his justice and benevolence to suppose man incapable of comprehending the nature of those laws, so far as they relate to his own happiness. For without knowledge there can be no obedience; and yet, we know that in our present state of existence the ignorant are not exempt from the penalties annexed to the non-observance of natural laws. The personification of these laws, and regarding their sanctions in the light of a direct interposition of an offended Deity, prevent mankind from observing the sequences between cause and effect, and may justly be regarded as the principal source of the barbarous rites and superstitions that have afflicted the nations of the earth from the creation to the present time. Besides, these views are calculated to degrade the idea of Deity in the minds of men by making Him the subject of passions similar to their own. But it is asked: how are these laws manifested, and what the tests by which they are known? They are written by the Creator upon all his works, and manifested to man through all his senses, they are very nigh unto him, in his mouth and in his heart, and unhappily for mankind, are continually recognized in the fruits of disobedience. They are known by the emotions of love which they excite towards both God and man; by our perception of their harmony with the attributes of Deity; by their tendency to elevate the condition, and promote the happiness of the human family; by their conformity with the word of revelation. These are some of the tests of moral and religious truths. And we commend them to the attention of all men who assume the responsible office of teaching others, while we respectfully admonish those who are in search of light, to reject all doctrine which does not come up to this standard, though it should be declared by one from the spirit land.

We are persuaded that it is owing to radical defects in the manner of presenting moral and religious truths to the minds of men, that the fruits of christianity have been so slowly developed, and that new systems of religious faith receive so much encouragement. It is difficult to convince the human mind that happiness in this world is inconsistent with a state of blessedness in a future; and if the doctrines of christianity are not so taught as to promote the happiness of individuals here, it is but natural that they should be attracted by any system, no matter how absurd and degrading, that promises future happiness, while it allows the indulgence of the passions and grosser appetites during their present state of existence. We would not lower the standard of moral excellence, but aim to elevate it by cultivating

a refined taste for the enjoyment of all things calculated to afford pleasure to the mind, that the hearts of men might rejoice and abound in gratitude to the Creator for his benevolence.

The destinies of the race are, under Providence, in the hands of those to whom the instruction of youth is committed; and while discoveries and improvements are being made in every other pursuit, will they rest satisfied with a system which is obviously too narrow for the attainment of that high degree of moral and religious refinement, which is necessary to develope those excellencies of man's nature so long obscured by the mists of ignorance?

The economy of man's being, and his relations to every object of sense present a wide field for the investigation of the philosopher, which would yield abundant fruit, if cultivated with skill and diligence. These investigations are calculated to place the wisdom and benevolence of the Creator in a clearer light, than they have heretofore been viewed by the mass of mankind; to harmonize the discordant doctrines which have confused and distracted the human mind from the beginning; to clothe deformity with the mantle of beauty, and give man a foretaste of a higher state of existence; to bring social enjoyments and reason to the support of religious faith, and prepare man for the change that awaits him.

The volume of revelation is complete; but the truths which it contains remain unexplored. Moral, like physical science is progressive, and the former, especially, cannot remain stationary; it must advance or decline. If new views of moral beauty and excellence are not continually presented to the human mind, it creates systems for itself, woven from the entangled thread of its own vain imaginings. And the moral phenomena of the age should admonish the friends of moral and religious truth, that extraordinary diligence and exertion are necessary on their part to preserve mankind from the influence of false and presumptuous teachers. The cause of humanity invokes their aid, and a sure reward awaits the performance of their duty.

ARTICLE II.

(From Hunt's Merchants' Magazine.)

## Ericsson's Caloric Engine.

One hundred and twenty years before the Christian era, a wheel, driven by a jet of steam, revolved in the Egyptian capital. More than nineteen centuries succeeded, marking their deep furrows upon the broad face of creation, before this whirling toy ri-

pened into the mighty Steam Engine, now so familiar to our race. During this vast period of time, sixty generations of men were born, and lived, and garnered for eternity. Of all the millions composing these generations, no man had appeared ingenious enough to drive pistons to and fro with that vapor, which had turned the playful wheel in Alexandria. That which now seems to have been its obvious application, nearly two thousand years were consumed in finding out. It required but a cylinder, a piston to move within it, grasping a crank, and with but few and simple contrivances beyond, the steam-engine was complete. That power which had created a rotary motion, could produce a reciprocating motion. To establish this neither experiment nor scientific learning was necessary; and if these had been required, both could have been abundantly supplied. Great geniuses had appeared, and scattered their rich gifts among men, and had passed away; failing to accomplish that which Watt finally completed. Human skill had multiplied luxuries, human invention had created innumerable comforts; but still mankind were as destitute of a Motive Power as when the Israelites journeyed from Egypt. At the end of the eighteenth century this power appeared. At length it assumed a form which enabled it to drag heavy burdens upon land and sea; and then, as the grim monster blew its hot breath from its iron lungs, the globe seemed contracted to half its former size.

In strength it was mightier than any moving thing, and in speed it rivaled the birds of heaven. It has become the strong carrier and the fleet racer. Glowing fires are its food, and its sinews hot vapor. Its unearthly shriek troubles the air, and its rolling tramp shakes the earth. It impels huge ships over wide seas; defying the hurricane and mastering the storm. It digs the ore, blows the furnace, wields the heavy hammer, and turns the spindle. It toils in the workshop; it toils in mid ocean, and it toils as it bounds along upon its iron track, unchecked by its ponderous train. It has traversed mighty waters, walked upon dark and troubled seas, darted through tunneled mountains, and coursed along western wilds.

Its years have been few. The nineteenth century dawned upon its early infancy, and the first half of that century closed upon its gigantic manhood. In this short period of time, it has stamped new and everlasting characters upon the history of mankind. It has accomplished a grand, and we believe its final destiny. We think its end is at hand, its mission nearly over. If it has been a useful slave, it has also been a costly and dangerous one.

To prevent this danger, the most watchful care, the profoundest skill, have proved unavailing. If the slaughter of our race, caused by its bursting boilers could be presented to view, humanity would stand appalled. Its course has been marked and its onward track strewn with mangled bodies. Of this the press, day by day, tells an awful story.

It is time that this fierce and expensive, though mighty bond-servant, should be replaced by one equally powerful, cheaper and less dangerous. The age is ripe for this change. The experience of the last few years has determined that steam cannot be profitably used, for commercial purposes, upon the ocean. For a voyage of three thousand miles, a large portion of the freighting capacity of the ship is required for coals alone. These, with the engine and huge boilers, occupy a part at least of that space, which should be filled with merchandise. The expense of the coal consumed is enormous; but this could be borne if it occupied less room. In proportion as the voyage is extended, does steam, as a motive power, become more expensive; until finally, the entire ship would be insufficient to contain the fuel necessary to feed the engine. A steamer of the Collins line consumes, we are informed, about one thousand tons of coal for a voyage of three thousand miles. Double this distance, and although the cost of the coal is but doubled, nearly the entire freighting room of the steamer is absorbed by it, and her power to earn freight is gone. Still increase this distance, with no means to supply fuel upon the route, and steam machinery becomes worse than useless. The broad Pacific cannot be traversed by it. Its rich commerce invites the merchant ship, and rewards the navigator, but the steamer must hug its shores, and cannot profitably explore its ample bosom. It is the mission of man to hold the earth and its waters in subjection by machinery. By machinery he is destined to lighten the drudgery which at the dawn of creation fell upon his race. To accomplish this he has been endowed with genius and inventive power; and where the force of a thousand giants would be fruitless, these triumphantly prevail. They gave to the world steam as a motive power. It has proved inadequate to the wants of men, destructive to human life, and more costly than the interests of commerce can sustain.

A new motive power is demanded, and if the eyesight and the judgment can be relied upon, it has appeared. It is the most sublime development of force ever seen in machinery! It is exerted by that life-giving, elastic fluid, the atmosphere. It is drawn from that vast magazine through which the lightnings play, and is supplied from that unseen element which sighs in the breeze and roars in the hurricane. We are not intimately acquainted with machinery, nor are we altogether ignorant of the principles of mechanical science. We know enough of both to form an intelligent judgment concerning the wonderful machine to which we allude, and which we have carefully examined. It is not, like most new inventions, presented in a mere model. It does not, like most new inventions, rest in bare experiment. Were these its conditions, the "Merchants' Magazine" would express no judgment concerning its utility, nor indulge in any speculations as to its supposed value. We should leave this task to those who are supposed to be better acquainted with the science of mechanics, and with the practical

value of untried inventions, than the editor of a commercial journal. We are not here called upon to perform this task.

A celebrated painter has said: "Let my productions be subjected to the judgment of the whole world, but heaven deliver me from that of my own profession." This may not, in a majority of cases, prove to be a just apprehension; but it is quite certain that there is in every profession a conservative spirit, which clings to the knowledge of the past, and distrusts that which is new and untried. This is strikingly illustrated in the case of the steam-engine.

We all know that, at this time, the only mode in use for producing a rotary motion, from the reciprocating motion of the piston of a steam-engine, is by means of a crank. It is equally well known, that to enable the stationary engine to "pass the center," a ponderous fly-wheel is employed. Now it will hardly be credited, that both these methods were at first condemned by distinguished engineers, as utterly impracticable. In 1777 Mr. Stewart read a paper before the Royal Society in London, describing a method for obtaining a continued circular motion, for turning all kinds of mills, from the reciprocating motion of the steam-engine. This he proposed to effect by means of a complicated contrivance, which practice soon proved to be worthless. In the course of his remarks, he incidentally noticed the method of obtaining the circular motion by means of a crank, which, said he, "*occurs naturally in theory, but in practice would be impossible.*"

This paper was, by the council of the Society, referred to Mr. Smeaton, one of the most distinguished engineers of that age. He not only condemned the crank, but the fly-wheel also; and, in consequence of these views, very complicated and expensive means were adopted, to produce the desired rotary motion from the reciprocating motion of the piston, until, at length, from necessity, the crank and fly-wheel were adopted, and ever afterwards used.

We have mentioned these circumstances to show the wisdom of the course pursued by Captain Ericsson, in not subjecting his invention to public examination, until he could present it in a shape so conclusive, as to satisfy the judgment of practical men, and to trample down that carping, sneering criticism, with which envy and rivalry sometimes seek to strangle the productions of inspired genius. This, in our opinion, he has accomplished. We have, with great care, examined this machine; the principles and construction of which were fully explained to us by the distinguished inventor. It is alike remarkable for sublimity of conception and simplicity of detail. Like the forces of nature, its operations, although mighty, are gentle. Two machines upon this plan are now in operation at the works of Messrs. Hogg & Delamater—one of five horse, the other of sixty horse power.

The latter is the most extraordinary piece of machinery we have ever seen. It has four cylinders. Two, of seventy-two inches in

diameter, stand side by side. Over each of these is placed one much smaller. Within these are pistons, exactly fitting their respective cylinders, and so connected that those within the lower and upper cylinders move together. Under the bottom of each of the lower cylinders a fire is applied. No other furnaces are employed. Neither boilers nor water are used. The lower is called the working cylinder; the upper the supply cylinder. As the piston in the supply cylinder moves down, valves placed in its top open, and it becomes filled with cold air. As the piston rises within it, these valves close, and the air within, unable to escape as it came, passes through another set of valves, into a receiver, from whence it is to pass into the working cylinder, to force up the working piston within it. As it leaves the receiver to perform this duty, it passes through what is called the regenerator, which we shall soon explain, where it becomes heated to about four hundred and fifty degrees, and upon entering the working cylinder, it is further heated by the fire underneath. We have said the working cylinder is much larger in diameter than the supply cylinder. Let us, for the sake of illustration merely, suppose it to contain double the area. The cold air which entered the upper cylinder will, therefore, but half fill the lower one. In the course of its passage to the latter, however, we have said that it passes through a regenerator, and let us suppose, that as it enters the working cylinder, it has become heated to about four hundred and eighty degrees. At this temperature, atmospheric air expands to double its volume. The same atmospheric air, therefore, which was contained within the supply cylinder, is now capable of filling one of twice its size. With this enlarged capacity, it enters the working cylinder.

We will further suppose the area of the piston within this cylinder to contain a thousand square inches, and the area of the piston in the supply cylinder above, to contain but five hundred. The air presses upon this with a mean force, we will suppose, of about eleven pounds to each square inch; or in other words, with a weight of 5,500 pounds. Upon the surface of the lower piston, the heated air is, however, pressing upwards with a like force upon each of its one thousand square inches; or in other words, with a force of 11,000 pounds. Here, then, is a force which, after overcoming the weight above, leaves a surplus of 5,500 pounds, if we make no allowance for friction. This surplus furnishes the working power of the engine. It will be readily seen that after one stroke of its pistons is made, it will continue to work with this force, so long as sufficient heat is supplied to expand the air in the working cylinder to the extent stated; for so long as the area of the lower piston is greater than that of the upper, and a like pressure is upon every square inch of each, so long will the greater piston push forward the smaller, as a two-pound weight upon one end of a balance will be quite sure to bear down one pound placed upon the other. We need hardly say that after the air in the working cy-

linder has forced up the piston within it, a valve opens, and as it passes out, the pistons, by force of gravity, descend, and cold air again rushes into, and fills the supply cylinder, as we have before described. In this manner the two cylinders are alternately supplied and discharged, causing the pistons in each to play up and down, substantially as they do in the steam-engine.

We trust our readers will be able, from the brief description we have here attempted, to understand at least the general principles upon which this machine operates. Its cylinders draw their supply from the atmosphere. The cylinders of the steam-engine are supplied by scalding vapor, drawn from hissing boilers. The caloric engine draws into its iron lungs, the same element which expands those of the most delicate child, and derives its motion and its power from that sustaining source upon which depends the existence of all animate life.

We have endeavored to explain the construction of the caloric engine. Its most striking feature consists in what is called by its inventor, the regenerator. Before describing this, we will present the grand idea upon which it is based. First let it be remembered that the power of the steam-engine depends upon the heat employed to produce steam within its boilers. It will be seen that from the very nature of steam the heat required to produce it, amounting to about 1,200°, is entirely lost by condensation the moment it has once exerted its force upon the piston. If, instead of being so lost, all the heat used in creating the steam employed could, at the moment of condensation, be reconveyed to the furnace, there again to aid in producing steam in the boilers, but a very little fuel would be necessary; none, in fact, except just enough to supply the heat lost by radiation. The reason is obvious. Let us suppose the steam has passed from the boiler, has entered the cylinder, has driven the piston forward, and is about to pass into the condenser, there to change its form, and be again converted into water. This steam, yet in the cylinder, and uncondensed, possesses all the heat it contained before passing out of the boiler. It has driven the piston forward, but in that effort it has lost no heat. That source of power it still contains.

Let it be supposed that the heat contained in the steam could, at the moment it is converted into water within the condenser, be saved, and by some device be again used to create steam from water within the boiler, with what exceeding cheapness could the power of the steam-engine be employed. But it is quite impossible thus to re-employ the heat of steam: it cannot thus be saved; and hence every effort to economize in this manner would be unavailing.

The propositions we have here advanced were, it appears, more than twenty-five years since familiar to the scientific mind of Capt. Ericsson. He was at that early period deeply impressed with their importance; and regarding heat as the sole source of motive-power,

was anxious to discover some element in which it could be so employed that, after giving motion to machinery, it should be returned to act over and over again for the same purpose. But little reflection was necessary to convince him that steam was not this element. It must consist of some permanent gas, and atmospheric air seemed admirably adapted to the purpose. Accordingly it was employed by him.

In a work entitled "A Dictionary of the Arts of Life and Civilization," published in London in 1833, the author, Sir Richard Phillips, mentions an engine which Captain Ericsson then had in operation in that city, as "his application of excited or rarefied air to the performance of those powers of machinery, which hitherto have been made to depend on the intervention of boiling water and its steam." The author further states that he "has, with inexpressible delight, seen the first model machine, of five horse-power, at work. With a handful of fuel applied to the very sensible medium of atmospheric air, and a most ingenious disposition of its differential powers, he beheld a resulting action, in narrow compass, capable of extension to as great forces as ever can be wielded or used by man."

The author adds:—"The principle of this new engine consists in this: that the heat which is required to give motion to the engine at the commencement, is returned by a peculiar process of transfer, and thereby made to act over and over again, instead of being, as in the steam-engine, thrown into a condenser, or into the atmosphere, as so much waste fuel."

During the last nineteen years, Captain Ericsson has employed much of his time, and expended large amounts of money, in overcoming those practical difficulties which are ever stumbling blocks in the way leading to the successful development of a great principle in new machinery. This he has now achieved. The principle of his invention, as stated by Sir Richard Phillips, is still retained, embodied in that practical and complete form, which render this engine economical, absolutely safe, durable, simple in construction, and in action effective.

Let us now attempt to describe the regenerator, to which we have referred. Without this, the machine we examined would possess, in point of economy, no advantage over the best constructed steam-engine. With it, the advantages are incalculable. We have already fully illustrated the leading idea conceived by Capt. Ericsson, of employing heat over and over again. To attain this is the object of the regenerator.

For the purpose of understanding this instrument, our readers will bear in mind the construction and operation of the machine. We have before stated that atmospheric air is first drawn into the supply cylinder, from whence it is forced into a receiver, and that from this it proceeds towards the working cylinder, before reaching which it passes through the regenerator. This structure is com-

posed of wire net, somewhat like that used in the manufacture of sieves, placed side by side, until the series attain a thickness, say of twelve inches. Through the almost innumerable cells, formed by the intersection of these wires, the air must pass, on its way to the working cylinder. In passing through these, it is so minutely subdivided that the particles composing it are brought into close contact with the metal which forms the wires. Now let us suppose, what actually takes place, that the side of the regenerator nearest the working cylinder is heated to a high temperature. Through this heated substance the air must pass before entering the cylinder, and in effecting this passage, it takes up, as is demonstrated by the thermometer, about 450° of the 480° of heat required, as we before stated, to double its volume. The additional 30° are communicated by the fire beneath the cylinder. The air has thus become expanded; it forces the piston upward; it has done its work —valves open—and the imprisoned air, heated to 480°, passes from the cylinder, and again enters the regenerator, through which it must pass before leaving the machine. We have said that the side of this instrument nearest the working cylinder is hot, and it should be here stated that the other side is kept cool, by the action upon it of the air entering in the opposite direction at each upstroke of the pistons. Consequently, as the air from the working cylinder passes out, the wires absorb its heat so effectually that, when it leaves the regenerator, it has been robbed of it all, except about 30°. In other words, as the air passes into the working cylinder it gradually receives from the regenerator about 450° of heat; and as it passes out, this is returned to the wires, and is thus used over and over, the only purpose of the fires beneath the cylinders being to supply the 30° of heat we have mentioned, and that which is lost by radiation and expansion. Extraordinary as this statement may seem, it is nevertheless incontrovertibly proved by the thermometer to be quite true.

When physical causes, productive of unexpected mechanical results, are carefully examined, they will always be found adequate to effect what, upon a cursory view might appear marvelous or incredible. Thus, after an examination of the reasons why this compact regenerator so effectually absorbs and transmits heat, its operation will cease to create wonder, although it cannot fail to excite profound admiration. We will state the causes of its efficiency.

The regenerator, contained in the sixty-horse engine we have examined, measures twenty-six inches in hight and width internally. Each disc of wire composing it contains 676 superficial inches, and the net has ten meshes to the inch. Each superficial inch, therefore, contains 100 meshes, which, multiplied by 676, give 67,600 meshes in each disc, and as 200 discs are employed, it follows that the regenerator contains 13,520,000 meshes, and consequently, as there are as many small spaces between the discs

as there are meshes, we find that the air within is distributed in about 27,000,000 minute cells. Hence, it is evident, that nearly every particle of the whole volume of air, in passing through the regenerator, is brought into very close contact wrth a surface of metal, which heats and cools alternately. The extent of this surface, when accurately estimated, almost surpasses belief.

The wire contained in each disc is 1,140 feet long, and that contained in the regenerator is consequently 228,000 feet, or 41½ miles in length, the superficial measurement of which is equal to the entire surface of four steam-boilers, each forty feet long, and four feet in diameter; and yet the regenerator, presenting this great amount of heating surface, is only about two feet cube—less than $\frac{1}{1920}$ of the bulk of these four boilers.

Involved in this wonderful process, of the transfer and retransfer of heat, is a discovery, which justly ranks as one of the most remarkable ever made in physical science. Its author, Captain Ericsson, long since ascertained, and upon this is based the sublimest feature of his caloric-engine, that atmospheric air and other permanent gases, in passing through a distance of only six inches, in the fiftieth part of a second of time, are capable of acquiring, or parting with, upward of four hundred degrees of heat. He has been first to discover this marvelous property of caloric, without which, atmospheric air could not be effectively employed as a motive-power. The reason is obvious. Until expanded by heat, it can exert no force upon the piston. If much time were required to effect this, the movement of the piston would necessarily be so slow as to render the machine inefficient. Captain Ericsson has demonstrated, however, that heat may be communicated to, and expansion effected in, atmospheric air, with almost electric speed; and that it is, therefore, eminently adapted to give the greatest desirable rapidity of motion to all kinds of machinery.

We here close our imperfect description of a machine destined, as we believe, to work a revolution in the Commerce of the globe. It consumes but a very small proportion of the coal required for the steam-engine. It is entirely free from every element of explosion or of danger. Watchfulness is not imperatively required, as in the steam-engine. If left unattended, the worst that can happen is, that after exhausting the heat of its fires, and of its regenerator, it will stop. The one we examined, of sixty horse power, has been run at full speed during twenty four consecutive hours, consuming but nine hundred and sixty pounds of coal. After feeding the fires, it continues to run three hours without replenishment, and after withdrawing them from the grates, it operates with full power for the period of one hour, in consequence of the astonishing action of its regenerator alone. We believe we have not, in the slightest degree, overrated the immense advantages of this engine, in point of economy and safety. If we have not, the world may well start with exultation. In magnitude of results, no in-

vention can rank with it. The electric telegraph is one of great interest and value, and to him who reflects that the fierce lightning has by that process been tamed, and brought to the very lips of man, there to be freighted with human language, and sent abroad, to girdle the earth with thought, it becomes sublime. Still, it is greatly inferior, in practical importance, to the discovery of a motive-power such as we have attempted to describe. Human speculation fails adequately to estimate its influence upon the social and commercial relations of men and of nations. Its effects will naturally be first exerted upon the ocean. It is here that the value of such a power will be most sensibly felt and appreciated. Here it will soon become the strong arm and right hand of Commerce. It may be affirmed with confidence that, with engines upon this plan, a ship of two thousand tons can be propelled from San Francisco to China and back with less coal than is now required for an ordinary ocean steamer to cross the Atlantic.

The annals of the mechanic arts furnish no instance of an important invention having been brought before the public in so complete a form as to warrant its being carried out on a scale of the first magnitude from the outset. Ericsson's Caloric Engine will form an exception. A ship is now building for its reception by Messrs. Perrine, Patterson, and Stack, measuring twenty-two hundred tons burden, and her engines, which are being constructed by Messrs. Hogg & Delamater, comprise four working cylinders, each of 168 inches in diameter. We have visited both the shipyard and the engine manufactory, and have inspected with more than ordinary interest the work on which more than four hundred men are now busily engaged. The ship is quite a remarkable structure, both in point of form and strength. The engines being placed in the center of the vessel admit of a better form of midship section than in steamships. Of this the builders have availed themselves by giving such a rise to the floor that strength and easy lines for passing through the water are appropriately combined. The lines of the ship at the entrance are singularly fine; and yet, by a very judicious application of the "wave line," as it is technically called, the bow possesses all the fullness requisite for a good sea-boat. The run is alike peculiar for easy lines, combined with stability and requisite bearing. The strength of floor, which is built entirely solid from stem to stern, surpasses anything we have seen in this country, noted as it is for producing the best ships in the world. In order to give additional strength to the ample timbers, the entire frame is banded by a double series of diagonal braces, of flat bars of iron, let into the timbers at intervals of about three feet, each series being riveted together at all the points of intersection. In addition to the ordinary central keelsons, there are six engine keelsons, bolted on the top of the floor timbers, for three-fourths of the length of the ship. On these keelsons the bed plates of the engines are secured by bolts passing

through the floor timbers. These bed-plates extend over the entire area occupied by the engines, and present a continuation of iron flooring, not witnessed in any steamship. The security thus attained is further enhanced by dispensing entirely with the numerous holes through the bottom of the vessel, which in steamers are necessary, and have often brought that class of vessels to a sinking condition. The engines being arranged in the center of the vessel, the decks are not cut off as in steamers; and as the whole of the machinery is confined within a vertical trunk 76 feet long, and 18 feet wide, ample space is left on each side of the ship for state-rooms along its entire length, with unbroken passages, fore and aft, on either side. The freight-deck also presents an unbroken area fore and aft, diminished only in width in the central part of the vessel. The coal being carried in the bottom, at each side of the engines, the fore and aft hold are clear for freight. The central arrangement of the engines involves, of necessity, a *central* crank, and thus the spar-deck presents an uninterrupted area, on both sides, the ordinary objectionable crank hatches being dispensed with. The slow combustion peculiar to the caloric engine renders the huge smoke funnel unnecessary. A short pipe to carry off the gases produced by the combustion in the furnaces takes its place in the caloric ship. The absence of steam in every form is sufficiently important in producing a more pleasant atmosphere than in steamers, but far more remarkable is the fact that the quantity of air which will be drawn out of the ship by the action of the supply cylinders of the engines, will exceed *sixty tons in weigth* every hour! Captain Ericsson, in calling our attention to this fact, furnished us with a few figures that we feel certain our readers will need, as much as we did, to comprehend how so vast a ventilation is effected. Each supply piston presents an area of 102 superficial feet, with a stroke of six feet. 612 cubic feet of atmospheric air will therefore be drawn into the engine at each stroke; and when the engine makes fourteen strokes per minute, 8,568 cubic feet. But as there are four supply cylinders, they will, in this space of time, draw in 34,272 cubic feet; and in 60 minutes there will be thus circulated 2,056,320 cubic feet. The weight of atmospheric air is nearly 13½ cubic feet to the pound; and thus it will be seen that 68 tons of air are drawn from the interior of the ship, through the engines, and passed off into the atmosphere, every hour. The effect of such an extraordinary system of ventilation, in purifying the atmosphere of the ship, is self-evident.

The simple construction of the caloric engine, and the small quantity of coal to be handled, will reduce the number of engineers and firemen, in the aggregate, to less than one-fourth the complement required for steamers. This great reduction in the number of men, whose duties are incompatible with strict cleanliness, will still further promote a purer state of atmosphere in caloric ships than in steamers. Again, as no smoke whatever is produced, when

anthracite coal is employed, the masts and rigging of the caloric ship will be as clean as in sailing vessels. We examined the combustion of the sixty-horse caloric engine most critically. No smoke could be detected from it, and we arrived at the conclusion, that with such a slow combustion and easy firing smoke cannot possibly emanate from the anthracite consumed in the furnaces. Europe has scarcely any of this fuel, and in a national point of view, therefore, the introduction of the caloric-engine is important. We congratulate the commercial world that this invention is to be presented upon a scale and in a manner commensurate with its surpassing magnitude. The commercial part of this enterprise is conducted by Mr. JOHN B. KITCHING, a merchant of the city of New York, who has, for this purpose, associated with him a few gentlemen of wealth and high standing. It is fortunate that he possesses the practical intelligence which has enabled him to appreciate the advantages to be derived from the introduction of this new motive-power. He at once concurred with Captain Ericsson, that its development in practice should so thoroughly test its utility and value, that no doubt could thereafter be entertained concerning either. So far as human scrutiny and foresight can penetrate, this invention promises to be the richest boon to Commerce and civilization yet attained by the application to machinery of those natural forces created by Omnipotence for the benefit of our race. Upon the manner of its first introduction to the world, will, in a great degree depend the time within which it will be made generally available in practice. Mr. Kitching will be remembered as the man whose sound judgment and perfect self-reliance have so contributed to present the caloric-engine to the public, that a second trial will not be required to warrant its universal adoption.

ARTICLE III.

From the American Railroad Journal.

## Mobile and Ohio Railroad.

CIRCULAR OF THE BOARD OF DIRECTORS.

*Mobile, August* 2, 1852.

The Directors of the Mobile and Ohio Railroad Company, having made provision for the grading, masonry, bridging and other local work of the entire line of this road, from Mobile to the Ohio river, (with the exception of a short link in North Mississippi and Tennessee, where subscriptions are sufficiently advanced to ensure the necessary amount before the first of October next,) propose, in pursuance of their original policy, to offer the six per cent bonds

of the Company, in London, having from twenty to thirty years to run, to the amount of five million dollars, or as great a portion thereof as may be required for the purchase of iron, equipments, etc., sufficient to place the whole road in full working operation.

Preparatory to entering the market for the first time as borrowers and for the better understanding of the nature and value of the securities which are to be presented to the consideration of foreign capitalists, as a basis of credit, the following brief exhibit of the origin, progress, resources and prospects of the company is submitted:

In the month of February, 1848, favorable charters were obtained from the States of Alabama, Mississippi, Tennessee, and Kentucky for the construction of a railway from Mobile, on the Gulf of Mexico, to a point at or near the mouth of Ohio river, by a company, under the corporate title of "THE MOBILE AND OHIO RAILROAD COMPANY." In May thereafter, books for subscription were opened at Mobile, and a sufficient amount of stock having been taken, the company was organized, June 7th, 1848, by the election of its first board of directors.

The first step of the directory, was the institution of a thorough instrumental survey of the country to be traversed by the road. Such a survey was commenced in October, 1848, under the immediate direction of John Childe, Esq., Engineer in Chief, with an efficient corps of assistants; was finally completed in the Autumn of 1849, and the results fully reported to the stockholders at their second annual meeting, July 5th, 1850.

The survey developed the fact, that the country, from Mobile to the mouth of the Ohio river, was eminently adapted for railroad purposes; presenting no natural obstacles in the way of a cheap, direct and level highway between the termini; crossing no navigable streams, but running parallel with the rivers, and upon dividing ridges elevated and beyond danger from freshets. Notwithstanding the favorable report of the Chief Engineer, and while the great feasibility and importance of the undertaking was everywhere admitted; yet the magnitude of the work, its ascertained cost, the apparent remoteness of its accomplishment, and the general indifference of the people of the interior, not then awakened to a spirit of railroad enterprise, rendered the task of accumulating means and confidence a work of time and difficulty.

The directors, however, well assured of the extraordinary merits of the undertaking, determined to proceed with such means as they could command, and accordingly thirty three miles of the road, extending north from Mobile, were placed under contract, and the work of construction commenced. Meanwhile, application was made thro' the State Legislatures, and by the company, to the Congress of the United States, for a grant of government lands, to aid in the construction of this road. That body, promptly recognizing in this enterprise a work of high public consequence, form-

ing in conjunction with the Central road of Illinois, a grand national thoroughfare, donated to the States of Alabama and Mississippi, alternate sections of the public lands, for six miles in width, on each side of the road traversing those States. This munificent donation was accepted by the States, and by acts of their respective Legislatures transferred to the use and benefit of the stockholders of the company. The effect was most auspicious. Public confidence, before withheld or wavering, became decided in favor of the ability of the company to carry through, with this aid, the work which they had undertaken; and the efforts of the directors to obtain stock were promptly responded to by liberal subscriptions. They have been thus enabled to take up the whole as an unit; to secure the means for the local work; and to perfect their plans for the simultaneous and rapid preparation of the roadbed throughout its whole extent.

The line is now finally located, and after a resurvey and carefully revised estimates upon the actual location, the entire cost of the road, including superstructure 65 lbs. per yard, depots, station houses, machine and repair shops, equipments, etc., etc., ready for full and active working operation, is estimated by the chief engineer at $9,750,000, of adding to the sum for extra contingencies, in round numbers, $10,000,000.

The resources in the hands of the directors, for construction, may be stated as follows:

| | |
|---|---|
| Thirty-three miles completed by Mobile subcriptions, costing | $500,000 |
| Real estate tax in Mobile, two per cent. per annum for five years (assessment $11,500,000 for 1852). | 1,100,000 |
| Proceeds sales village lots at 13 and 33 mile stations | 50,000 |
| Private and county subscriptions in Alabama and Mississippi, (county subscriptions payable from special taxes each year | 1,305,000 |
| Do. do., Tennessee and Kentucky | 700,000 |
| | $3,655,000 |

Making the total resources thus far available for the construction of the road bed $3,655,000. In addition the entire right of way has been obtained for the road—in most cases having been freely given, without cost to the company; while for a nominal sum a large and valuable depot ground—forty acres in extent—has been secured in Mobile, together with a valuable water front and extensive and commodious wharf privileges at the north and south parts of the city.

Beyond the means thus provided, and subscriptions now in progress, the sum of five million dollars will be ample to cover the entire construction account, and place the road in complete and profitable operation. An act of the Legislature of Tennessee, at its last session, authorises the endorsement by that State of the com-

pany's bonds for eight thousand dollars per mile, upon the portion of the Mobile and Ohio road passing through Tennessee. This endorsement will amount to about one million dollars.

The purchasers of the bonds of the company will receive as guaranty and security for their payment at maturity—

(1.) A first and only mortgage lien upon the whole road of five hundred and seventeen miles in length, (including the branch of 23 miles to Tennessee river,) together with all its appurtenances, machinery, fixtures, etc., costing say ten million dollars.

(2.) An endorsement by the State of Tennessee upon one million dollars of these bonds.

(3.) A first and only mortgage lien upon one million acres of Government lands, donated in aid of the road, and located within fifteen miles of the track in the States of Alabama and Mississippi, worth, when the road is completed, an average of three dollars per acre, or three million dollars.

An examination of the peculiar features and characteristics of the route of the Mobile and the Ohio railroad, will at once establish its value as an investment, and its soundness as a security to the extent applied for.

1. It is, and will be for all time, the shortest practicable route between the Ohio river and the Gulf of Mexico, being only eleven per cent. longer than an air line.

2. It will be a north and south line, crossing the parallels of latitude, and extending by its connection with the Central Illinois line, from one extreme of the Union to the other, crossing over twelve degrees of latitude, and the consequent variety of climate and production.

3. It will be nearly a straigth road, having few curves, and those of large radius; with a maximum grade moving south, not exceeding thirty feet to the mile, and going north not exceeding forty feet to the mile; thus giving it a higher capacity for cheap, certain, speedy and heavy freight transportation than any other long road now constructed.

4. The great length of this road under a single management; the absence of large streams upon the route, rendering it less liable to disaster from high water; the mild climate, and freedom from the action of frost; and other favorable circumstances, will combine to make its net annual income larger in proportion to the gross receipts, than is possible upon the best managed roads of the northern States.

5. Long lines of railway now in progress, east and west, will cross this road at various points, making it the most accessible and convenient route of transit to the Gulf for a vast area of country. One hundred and twenty miles north of Mobile the Alabama and Mississippi railroad will intersect the Mobile and Ohio road, forming westwardly a continuous line to Vicksburg, Mississippi, and

eastwardly to Charleston, South Carolina. About two hundred miles further north, the Memphis and Charleston railway will also connect this road with Memphis, Tennessee, and the various lines eastward to the great thoroughfares of the Atlantic slope of the Alleghanies. In North Mississippi, a branch diverging to Nashville, Tennessee, again divides north of that city into two important lines, extending to Louisville and Cincinnati. In Tennessee, one branch rests upon the Ohio, at Paducah, and another terminates on the Mississippi at Columbus, Kentucky, while the main stem to Cairo unites with the Central road to Illinois, and forms a connection with an extended network of railway, spreading over the whole western valley, and converging towards the Gulf, upon this great trunk line.

6. This road will pass, for one hundred miles, over a heavily timbered country, abounding in lumber of excellent quality, for which Mobile is rapidly becoming a large market; and after leaving the forest, will strike one of the most fertile cotton regions of the South; again leaving which, it will enter the wealthy grain-growing districts of West Tennessee. The local traffic which will be furnished by the wealthy country immediately dependent upon this road for an outlet to the sea, will alone make it a profitable line for the stockholder.

7. The cost of the road will not exceed the estimates. They have already been verified in part by the completion of 33 miles of the work at $1,655 per mile less than estimated, and the further contract of 55 miles, also at rates within the figures of the chief engineer; and from the abundance of provisions the coming year, now rendered certain by the favorable season, a fair prospect exists of making a greater saving upon the contracts soon to be offered.

8. The estimates of business and income are rather under than over the mark. They are based upon actual data of the products, commerce, population, etc., of the counties dependent upon the road; and are made by an officer of large experience, sound judgment, and thorough knowledge of railroad affairs, whose approximations heretofore have been found remarkably correct. In his official report to the diretors, Mr. Childe estimates the net income of this road at 14¾ per cent. upon its cost, and says: "From a careful examination of the country, its products, and present tedious and expensive modes of reaching the markets, I feel great confidence that the road will, in no case, fall short of the amount of traffic and income stated above for the first year, commencing six months after the divisions shall be fully and respectively completed."

9. The road is now in active healthful progress. As stated, above 33 miles are completed and in operation; 55 miles more of the line is under contract for the graduation, masonry and bridg-

ing, upon which a large force is now actively employed; 179 miles further is advertised, and will be contracted before 1st of October next; and the remainder of the line to the Ohio river at an early day thereafter. By the time the iron can be laid down in Mobile, the most forward sections will be ready to receive it, which will enable the company to bring the southern portion of the road into early profitable use, and provide for the first instalments of interest upon their loan from its earnings, thus retaining the principal nearly unimpaired for purposes of construction alone.

The directors feel satisfied that, for the reasons herein set forth, a mortgage upon the road itself would constitute an abundant and ample security for a loan of the amount required, namely $5,000,000, or about one half its cost.

But they propose to offer the additional guarantee of the credit of the State of Tennessee for 20 per cent. of the entire loan, as provided by act of her legislature—a State whose securities (6 per cent.) are now quoted at 109½ to 110, or nearly 10 per cent above par. This recognition by Tennessee of the Mobile and Ohio road furnishes evidence, to which the directors could add nothing, to increase its weight, or commend it more strongly to consideration.

Again, and in addition to these, the company holds large and valuable tracts of land bordering upon the road, the gift of the general government, containing about one million acres. A portion of these lands is covered with heavy forests of valuable timber; another portion embraces excellent lands; and the whole is equal in fertility to the average of the country through which the road passes. These lands at the lowest valuation, will be worth, the moment the road shall be completed, fully one-half the amount to be loaned to the company, or one-fourth the entire cost of the work. If withheld from sale for a few years after the completion of the road, it is believed that a much larger sum may be realized from their disposal, estimated at 40 per cent. of its cost, or four-fifths the amount of the company's proposed loan. A first lien upon these lands will also be given in trust to the bondholder, as security for the loan.

The basis of credit which the company has thus established, as briefly set forth in this communication,—into the correctness of which in all particulars the closest scrutiny is invited and desired—and the perfect and complete security that is offered, will, the directors feel assured, attract the attention of capitalists, and place the bonds of the company where they of right belong, upon an equal footing with the best first class securities offered in any market.

NOTE.—The county subscriptions mentioned upon page 3 are to be collected by special tax, levied for the purpose, and not by the issue and sale of county bonds. The Mobile tax it is now believed will yield nearly $1,500,000 in consequence of the rapid improvement in real estate, upon which the assessments are made.

ARTICLE IV.

(From Appleton's Mechanics' Magazine.)

## Heat, Combustion, and Fuel.

There are three modifications of heat of which philosophers speak: sensible heat, latent heat, and specific heat. *Sensible heat* is the heat which is observable by the thermometer, or discoverable by the senses; and this kind of heat exists in every thing with which we are acquainted; for, as we know of nothing so cold but what it might be colder, there is nothing without a certain degree of heat in the whole range of our experience.

*Latent heat* is defined to be that heat which is not discoverable by the thermometer, but is expended in producing a change of state, as in the liquefaction of ice or the vaporization of water. If an open vessel of water be placed upon a fire, the temperature of the water will not rise above the boiling point, or 212 degrees, however long the boiling be continued, although the water must have been all the while receiving accessions of heat from the fire. All the heat received over and above that requisite to produce the temperature of 212°, is expended in the formation of steam, but the steam itself does not rise above 212°; and on account of the heat thus hiding itself, as it were, in the steam, it is called latent heat.

The latent heat of steam is said to be 1000°, which means that it would take 1000 times more heat to raise a pound of water into steam than to raise it one degree in temperature; or what is the same thing, the heat required to raise a pound of water into steam would raise 1000 pounds of water one degree. From this it appears that it requires about 5½ times as much heat to raise any given weight of water into steam, as would raise the same weight of water from the freezing to the boiling point. The freezing point is 32°, and the boiling point 212°, so that the amount of difference, or the number of degrees through which the temperature has to be raised between the freezing and boiling points, is 180°, and 180° multiplied by 5½ is 990, or 1000 nearly.

Specific heat means the quantity of heat contained by one body at a given temperature, compared with the quantity contained in another body at the same temperature. It by no means follows that the same weights of different bodies at the same temperature contain the same quantities of heat, any more than that the same bulks of different bodies contain the same quantities of matter; and the specific heat of a body indicates the quantity of heat it contains, just as its specific gravity indicates its quantity of matter. The specific heats of a great number of bodies have been ascertained and arranged in tables just as their specific gravities, and

the specific heat of water is taken as the standard. The specific heat of steam, for example, is rated at ·847, that of water being 1. But there are very few of the experiments on the specific heats of aeriform bodies, upon which much dependence can be placed; as the investigation is one of infinite difficulty, from the delicacy required in the manipulation, and the minuteness of the result that is to be caught.

A great deal of confusion has been cast over the subject of specific heat by the accredited definition of latent heat, which is said to be the heat absorbed by bodies during a change of state from solid to liquid, and from liquid to aeriform, whereas it ought to be the heat absorbed without elevation of temperature, whether there be a change of state or not. The practical engineer, however, need not puzzle himself with the various theories on this subject, but endeavor by a system of careful observations to collect such data as will aid the philosopher in arriving at correct conclusions, and the basis for a sound theory of heat and combustion.

It will suffice to mention that there are two theories respecting the nature of heat: the one regards it as a material substance, and the other as a mere undulatory motion in the molecules of bodies, or in a highly elastic and subtle fluid which pervades all space, and which is capable of transmitting vibrations. As philosophers still differ upon this object, it is not to be supposed that we shall perplex ourselves with it, especially as engines will work equally well whatever theory be the correct one. The inquiry, however, is not without interest, as, if the doubt were resolved, we should perhaps have such light thrown upon the modes of exciting heat, as might greatly conduce to economy in steam machinery, and at least we should then be able to construct furnaces more scientifically.

Heat is communicated to other bodies in three ways—
1st. By direct contact, called *Conduction.*
2d. By carrying, called *Convection.*
3d. By right lines, called *Radiation.*

*On Conduction.*—When heat passes from particle to particle of a solid body, it is said to be *conducted;* thus, if a bar of iron be put into the fire, the heat travels from one end to the other by conduction.

Many bodies conduct very badly; indeed, gases, and fluids, and earthy substances scarcely conduct at all. If heat be applied to the upper surface of water, a thermometer at the bottom of the vessel will not be affected by it. This remark must be borne in mind in the construction of steam-boilers. Metals are generally good conductors, though there is a sensible difference in their power in this respect. Thus, by Despretz's experiment, the conducting powers of some few substances will be represented by the following table:

| | | | |
|---|---|---|---|
| Gold | 100 | Lead | 17·96 |
| Platinum | 98·1 | Marble | 2·34 |
| Silver | 97·3 | Porcelain | 1·22 |
| Copper | 89·82 | Brick Earth | 1·13 |
| Iron | 37·41 | Fire Clay | 1·14 |
| Zinc | 36·37 | Water | 9 |
| Tin | 30·38 | | |

The knowledge of the difference of the conducting powers of substances is of great utility; for by these means it is possible to keep any material hot or cold, at pleasure, for a considerable time. If the source of heat be *internal*, and we wish to keep it warm, it must be cased in some *non*-conductor, such as flannel or felt. Porous substances are generally bad conductors, and this may probably be the reason a layer of snow is so effective in preserving the temperature of the ground.

Good conductors feel hotter or colder than bad conductors of *equal* temperature, according as their temperature is above or below blood-heat, because they are more ready to give out or absorb heat; thus, if a piece of iron and a piece of wood be exposed to the influence of the atmosphere, the iron will *feel* much hotter than the wood when both are exposed to the meridian sun, while it will *appear* to be colder than the wood at midnight.

*Convection.*—Liquids and gases, though bad conductors, may still transmit heat by the law called *convection*, which may be explained as follows: If heat be applied to the *lower* particles of a fluid mass, it will cause them to expand, and therefore their specific gravity becomes less than that of the upper strata; consequently, a displacement of the particles ensues, the lighter rise to the surface and are replaced by the heavier ones, which in their turn become heated and are replaced by the others, and so by this process the heat is conveyed throughout the general mass. The same yrinciple applies to gases.

The advantages to be derived from a knowledge of this law are apparent in apparatus for boiling fluids, where the fire should be applied as low down as possible; the surface exposed to the fire should be large, and there should be a facility for the heated particles to rise to the surface. This principle also explains the whole theory of ventilation. If we confine air in a close vessel, and apply heat to the lower strata, a continual interchange will take place; but if we make two orifices, one in the lower part of the vessel, and another in the upper, the heated air will escape at the higher orifice and its place be supplied by that which enters at the lower one, and a continual draught be produced through the vessel. Hence it follows that a tall, upright shaft, produces a violent current of air through a furnace; yet there are limits to the practical application of this principle, from the cooling of the upper portion of the column, and from the friction of the air against

the sides of the shaft. The wind-sails of a ship afford an instance in which the law of convection is made available for ventilation; we may also mention the casing placed round the funnel of a steam-boiler to prevent its burning the deck. There would be no advantage from this casing if the air were confined between it and the funnel; but the top is open, and the casing is pierced with holes below the deck, whereby the warm current of air from the top of the boiler and engine-room enters, and by continually ascending is dissipated in the atmosphere without becoming very hot.

*On the Law of Radiation.*—By radiation a hot body gives out its heat just as a luminous body gives out its light. Although the rays of heat are not visible to the eye, they are sent out in every direction in straight lines, becoming more and more faint as the square of their distance increases; thus the effect of radiant heat is $\frac{1}{4}$th at a double distance; $\frac{1}{9}$th at three times the distance, and so on.

The radiating power of bodies depends principally on the nature of the surface. Those bodies whose surfaces are rough radiate most, and polished substances radiate least. If a steam-pipe or cylinder be coated with felt, it will diminish the convection; but let us suppose a portion of the heat to have reached the outer surface of the felt, then from its roughness heat would readily escape by radiation. To prevent radiation, therefore, we should coat the felt with canvass and paint it; the varnish of the paint will give a smooth outer surface, and conduce by its color to diminish the radiation.

Heat appears to be a compound derived from the union of a combustible with an incombustible, which supports or supplies the constituent part necessary to complete combustion, and without which definite supply combustion is imperfect. This combination infers different qualities of the two ingredients in the compound of heat. Strictly, the process of combustion is complex, and only partially understood. As far as regards its ordinary operation in the steam-boiler fireplace, we will endeavor to convey a clear exposition of its more important features.

A coal, for instance, thrown on a fire, evolves, amongst others, the two principal combustibles of carbon and hydrogen, which, uniting with the oxygen of the air, an incombustible yet a necessary supporter of a fire, produces heat and light at the same time. Simple as this may appear, its analysis is yet a complicated chemical problem. The chief agents operating in the furnace, are carbon, hydrogen, and oxygen, and their union in certain proportions produces other bodies, as water or steam, carbonic oxide, carbonic acid, besides others of less practical importance.

The combustibles universally used in the furnaces of steam-engines are either coal or wood. The former is used almost invariably in Europe, the latter is still used in this country in particular districts.

The constituents of coal are chiefly carbon and a gas called hydrogen, combined occasionally with a small proportion of sulphur and incombustible matter.

In the process of combustion, the carbon, the hydrogen and the sulphur combine with the oxygen gas, which is a constituent of the atmosphere, and other products are formed. In this combination a quantity of heat is developed. The incombustible constituents drop from the grate, and are left in the ash-pit. The goodness of coal depends in some degree on the small proportion of incombustible matter which it contains.

The proportion of carbon contained in coal varies; in good coal it is seldom less than 75 per cent. of the whole, sometimes considerably more.

Hydrogen cannot be said to enter as a constituent of coal in its pure and simple form. It is always combined with a portion of carbon, and is the gas called *carburetted hydrogen*, being that which is commonly used for the purpose of illumination. This gas may be expelled from coal by exposing the latter to heat, by which means the gas, expanding, is forced from the interstices of the coal, and may, if required, be collected in proper reservoirs. This process, applied to the coal, is called coking; and it is in this manner that the gas is collected in gas-works for the purposes of illumination.

The proportion of carburetted hydrogen, the element which produces flame, varies in different sorts of coal. The more bituminous sorts generally have a considerable proportion; the heavy coal called stone-coal, or anthracite, obtained in some of the coal-fields of Wales, Pennsylvania, and elsewhere, have very little. In all cases the proportion of this element by weight is insignificant.

Carbon burns without flame, the product of the combustion being the gas called *carbonic acid*, which escapes from the fuel in a very heated state.

These are the general effects of combustion; but for the practical purposes of art, something more must be learned. We must ascertain with some degree of precision the quantitative proportions in which the various elements concerned in the phenomena are present.

To begin, then, with the chief ingredient of all combustibles, carbon:

This substance, when heated to a temperature of 700° or 800°, equal to that of red-hot iron, will enter into chemical combination with the gas called oxygen; the result of this combination will be another gas, called carbonic acid. In forming this combination a large quantity of heat, previously latent in the carbon and the oxygen, is rendered sensible, and is developed in two ways: 1st, in rendering the remainder of the carbon incandescent, or white-hot; and 2d, in raising the temperature of the carbonic acid which has been produced to a very high point.

From the luminous or incandescent carbon the heat escapes by radiation, according to the same principles and laws that govern the radiation of light. That portion of it which is carried off by the carbonic acid may be taken from such gas by placing in contact with it any surface which is a good conductor of heat, such as metal: the heat of the gas will be imparted to the metal until the temperatures of the metal and the gas be equalized.

But it is necessary to know the *quantity* of oxygen gas which is requisite to combine with the carbon.

It is found that a pound of pure carbon will enter into combination with 12 cubic feet of oxygen at the ordinary temperature and pressure of the air, the result of the combination being 12 cubic feet of carbonic acid, this being supposed to be reduced to the same temperature and pressure. But as the temperature of the carbonic acid, at the moment of combination, is very much elevated, it will then have an enlarged volume.

Common combustion, however, is maintained not by an atmosphere of pure oxygen, but by that of the common air.

Common air is a mixture of oxygen and azote, in the proportion, by measure, of 1 to 4—five cubic feet of common atmospheric air containing but one cubic foot of oxygen. To obtain twelve cubic feet of oxygen, therefore, we must necessarily have 5 times 12, or 60 cubic feet of common air.

Supposing then (which is, however, in practice not the case), all the oxygen contained in the atmospheric air supplied to the fuel in combustion to enter into combination with such fuel, it would be necessary to supply 60 cubic feet of atmospheric air for every pound of carbon consumed.

The result of this combination would be the production of 12 cubic feet of carbonic acid, formed by the combination of the oxygen of the atmosphere with the carbon, and 48 cubic feet of azote, which would be mixed with the carbonic acid so produced. This volume of mixed gases would escape from the fuel at a very high temperature, and would in this state pass into the chimney.

Hydrogen gas combines with 8 times its own weight of oxygen, and the result of the combination is water, or, more properly speaking, steam; for it is rendered into the vaporous form by the great heat developed in the combustion.

We have stated that a small proportion of sulphur is present in most sorts of coal. In burning, this produces sulphurous gas. It is inefficient as to its heating power, and insignificant in its quantity, but most injurious in its effects on boilers. Coal, therefore, having much of this element, should be avoided in steam-boilers.

To maintain the fuel in combustion, it is then evident that it must be continually supplied with atmospheric air. The rate of this supply will depend on the rapidity of the combustion which is required, and the quantity and quality of the fuel. The fuel is

spread on a grate, between the bars of which the air which sustains the combustion is admitted. In passing through the fuel, the air enters into combination with it, and the gases resulting from the combustion, including uncombined oxygen and the azote of the atmospheric air, which last plays no part whatever in the combustion, issue together into the upper part of the furnace, all having a very high temperature; these proceed to the chimney, which they soon fill with a column of heated air, the buoyancy of which makes it ascend into the atmosphere, and the vacuum it leaves behind it draws a fresh portion of air through the grate bars, and so the combustion is continued.

The azote, which forms so large a constituent of atmospheric air, has qualitities in relation to combustion merely of a negative kind; it does not either check or stimulate it. Thus, as a supporter of combustion, the atmosphere may be considered as diluted oxygen, the azote having the same effect on the particles of the oxygen as water would have upon a strong spirit mixed with it.

In what has been just explained, the calculations are based upon the supposition that every particle of oxygen contained in the atmospheric air, urged through the burning fuel, enters into combination with it. Now this is not, and cannot be the case, even in the most approximative sense; and therefore, to complete the combustion of the fuel, a much greater quantity than 60 cubic feet of atmospheric air for a pound of carbon consumed must be drawn through the fire. The exact quantity which is necessary is not capable of calculation, for it depends on circumstances which vary with the form and structure of the grate and the mode of working the furnace; but it may be safely assumed that not less than from 150 to 200 cubic feet of atmospheric air are necessary in ordinary furnaces for the combustion of each pound of carbon contained in the fuel.

It will be understood that when the fuel is laid in a stratum more or less thick upon the grate, and when rapid currents of air are ascending through its interstices, a quantity of the fuel, always existing in the state of powder or small dust, will be carried upward by the current, unburned.

Besides this, as the heat expels the hydrogen gas from the interior of the coal, minute particles of the coal itself escape with the current, and rise above the fuel. Much of this is also unburned, or, to speak scientifically, uncombined with oxygen. It is this minute powder or dust, uncombined with oxygen, that forms what is called smoke. The gaseous products of combustion, properly so called, have not the cloudy and opaque appearance which characterizes smoke. This smoke, then, is unconsumed fuel, and to whatever extent it is produced, it escapes into the chimney, and is a source of waste. It is clear, then, on the grounds of economy, that the quantity of fuel, more or less, thus escaping, should be arrested and burned before it reaches the chimney.

We proceed to an exhibition of the value of the several kinds of fuel in use for marine engines—the result of carefully conducted experiments made, on an extended scale by order of our government, by W. R. Johnson, Esq. These experiments were all conducted with the same furnace, and if the results should not prove absolutely correct for all forms of furnaces, they are yet relatively so. We confine our selections from his report to a condensed summary suited to the wants of practical men.

The value of any particular variety of fuel will depend principally upon the evaporative power of its unit, and the number of units that can be stowed in a given space. But this will be materially modified by the grate surface required to furnish (with equal velocity of draught) the necessary amount of air for combustion; for, in marine steamers, the great surface is limited by the beam of the vessel—the maximum length of the furnace being fixed by practice at 7 feet, beyond which it cannot be extended beneficially on account of the difficulty in firing. Again, the relative amount of clinker and soot are important to be considered, as the one, by covering the grates, prevents the access of air and retards combustion; while the other, by covering the flues, acts as a non-conductor and prevents the absorption of heat. Lastly, the per centage of sulphur is of some importance as its presence is decidedly injurious to the iron of the boiler; and in a minor degree the per centage of ashes should be considered, as they involve the labor of hoisting them overboard, besides occupying room in the furnace. A comparison of these properties will be found in the table.

From an examination of the tabulated results of this series of experiments, it appears that, of the dry gases (products of combustion) in the flue, 10 per cent. of bulk consisted of uncombined oxygen. As the proportion of oxygen by bulk in atmospheric air is one-fifth, there results that 50 per cent. of the gases in the flue was unchanged atmospheric air, and as carbonic oxide is nowhere observed, this whole quantity of atmospheric air is in excess over what was required for combustion at the experimental temperature.

The temperature of the gases upon entering the smoke chimney—that is, upon leaving the boiler—averaged 294° F., which, upon estimating the temperature of the furnace at 1000° F., gives a reduction of two-thirds of the heat. This indicates that a corresponding reduction of area of flue should be made; otherwise the gases with the reduced temperature would have a correspondingly reduced bulk, and if continued in a flue of the same area, would have a less velocity, and be accompanied by a greater deposition of soot. The gases had a velocity of exit into the chimney of 11½ feet per second, there being on an average 8 pounds of coal consumed per hour on each square foot of grate. The area of flue at

the bridge was 23½ square inches to each square foot of grate. The smoke chimney was 58 feet high, with an area of 22½ square inches to each square foot of grate.

The proportion of grate to heating surface was 1 to 26, and each square foot of grate surface contained 50 square inches of air surface. The grate bars were ¾ inch thick, with ½ inch spaces between them.

The average evaporation by each pound of coal per hour was 223 cubic inches of water by the anthracites, and 206 cubic inches of water by the bituminous, from the initial temperature of 63°, the air entering below the ash-pit being 70° F. From each square foot of heating surface there was evaporated by the anthracites 55 cubic inches of water, and by the bituminous 61 inches of water; the escaping gases being at the respective temperatures 273° and and 302°, or the ratio of 1 to 1·106. The ratio of 55 to 61 is 1 to 1·109, or very nearly corresponding.

The per centage of total waste from the anthracites compared to that from the bituminous was as 1 to 1·07. The comparative per centage of clinker alone was as 1 to 2—of soot alone as 1 to 5·70.

The bulk of air at standard pressure of 30 inches barom., and temperature of 60° F., required for the combustion of the anthracites, was, as compared with that required for the bituminous, as 1 to 0·724.

The spec. grav. of the anthracites was 1·50; of the bituminous, 1·33.

The space required to stow one ton of the anthracites was 42·14 cubic feet; of the bituminous, 45·57 cubic feet, or the ratio of 1 to 1·06. The per centage of evaporative power expended in expelling the products of combustion, was, for the anthracites, 14·58; for the bituminous, 16 34, or in the ratio to each other of 1 to 1·121.

In the single experiment on dry pine wood, its evaporative power for the unit of weight was one-half that of coal, and the same grate surface and draught consumed twice the quantity by weight per square foot of grate, showing that the same proportions of boiler would give the same result—of course, requiring twice the weight of fuel. Now the pine wood when piled with extreme attention to placing the maximum of matter in a given space, weighed 21 pounds per cubic foot, requiring twice and a half the space to stow equal weights with coal; therefore there would be required for dry pine wood five times the space required for equal coal, to produce evaporative effects.

With the most rapid combustion the proportion of clinker was highest, and the usesul effect from the fuel greatest. When the combustion was most retarded by partially closing the damper, there resulted the greatest per centage of waste and the least useful effect from the fuel. This is accounted for by the want of air,

by the stifling effects of the products of combustion retained near the fire, and by the increased quantity of smoke produced in such cases by the diminished temperature of the furnace.

Experiments upon a mixture of anthracite and bituminous coals establish :—that when a coal of high bituminousness was mixed with anthracite, the coking of the former materially agglutinates, not only its own masses, but also those of the anthracite, closing the open spaces of the latter, and preventing the easy access of air; causing the fire to become sluggish. But with a free-burning bituminous coal, the bituminous lumps scarcely cohere, and still less do they adhere to the anthracite. Each ingredient of the mixture retains its distinct evaporative power, the total being the sum of both.

The experiments seem to prove, as before remarked, that the carbon in coal is the only *available* element of its heating power. Those who have sought to determine the heating power of fuel for practical purposes, by computing the heating power of its hydrogen from the data given by chemists, appear not to have considered, that the hydrogen experimented on by chemists was already in the gaseous state, while in fuel it is either in the liquid or solid form at the commencement of combustion, and is converted into the gaseous state at great expense of caloric, which is rendered latent, and cannot be again made free. The practical value of this loss is also increased, when the products of combustion pass away at a higher temperature than that of the water supplied for evaporation.

ARTICLE V.

## Steamship Mail Service of the United States.

We copy the following account and statistics relating to the transportation of the mails on ocean steamers from the U. S. Senate committee on the post office and post roads :

With a view to a full and fair understanding of this important subject, your committee have communicated, through their chairman, with the Executive departments of the government and the presidents of the various companies engaged in carrying the ocean mail by steam, and will now proceed to lay before the Senate the results of their careful inquiries. It may not be improper here again to note, by way of illustration, the benefits to be derived from ocean steam mail transportation, when in successful operation, as manifested in the case of the British Cunard line, under the auspices of the British government. During the first six years

of its existence, the line above named received from the government no less than $2,550,000, while the government received from the company, in the form of postages, the enormous sum of $7,836,800, or $5,286,800 nett revenue.

The line of ocean mail steamers, usually called the Collin's line, has been in operation since the month of April, 1850, or about two years; the ships had made, previously to January last, forty-two trips, from New York to Liverpool, and forty, from Liverpool to New York. The contract for the transportation of the United mail between the places above named was made on the 1st day of November, 1847, the law which authorizes it having been passed on the 3d of March preceding.

The line consists of the following vessels, viz:

| | | | | |
|---|---|---|---|---|
| The Atlantic | 2,845 66-95ths | tons burden | commenced | April 1850 |
| The Pacific | 2,707 10-95ths | " | " | May 1850 |
| The Arctic | 2,856 75-95ths | " | " | October 1850 |
| The Baltic | 2,723 9-95ths | " | " | Novem. 1850 |

These ships cost, when ready for sea, in cash, $2,944,142 76, or an average of $736,035 67 each.

They have made forty-one voyages between New York and Liverpool, at an average expense of $65,212 64 per voyage, making, in all, the sum of $2,673,841 24, which, when added to the cost of the ships, say $2,944,142 76, makes the entire amount of money expended $5,617,984.

On the other hand, the average receipts of the company, per voyage, have been, as stated, $48,286 85, or in all, $1,979,760 85—amount advanced, $208,000—and amount paid for two years mail service, $770,000, making the total receipts from all sources, $2,957,760 85.

If the amount of receipts, as above, be deducted from the amount of expenditures, say $5,617,984, the balance against the concern will be $2,660,223 15, and if the original capital subscribed be deducted, to wit: $1,132,000, there will remain an outstanding deficiency of $1,528,223 15, to be met by the present value of their ships.

In the meanwhile the company has paid to the government two annual instalments upon the $385,000 advanced, which, at ten per cent. annually, upon the sum loaned, amount to $77,000, reducing the balance on its debt to the government to $308,000, which is in the course of being paid at the rate above named, and will have been cancelled entirely in eight years from this time, the ships being held as security until the whole debt shall have been paid.

The whole amount earned by this line, in letter postage, up to the 1st of March last, has been $373,337 80, which sum is taken as the fair basis of calculation, as the three twenty-fourths due to the British government has been met, by as large or a larger sum due from that government for the five twenty-fourths payable to

the government of the United States upon the earnings of the Cunard line, under the postal treaty between the two countries. Taking, then, the gross amount of receipts from letter postage, say $373,337 80, and adding to it $3,200, for postage for the State Department, $90,151 58 for closed mails for the continent, carried by this line, and $46,858 88 postage for newspapers, the aggregate earnings for the government by this line will have been $513,546 80.

Thus it appears, that from a fair statement of the account current between the line and the government, the latter is out of pocket, at the end of the two first years of the undertaking and under circumstances the most disadvantageous to the line, $256,453 20, or in other words, has paid $128,226 60, per annum, for carrying the ocean mail by steam over about six thousand miles of the greatest commercial thoroughfare in the world, for which, as yet, it has received nothing in return. But your committee would ask, what has *the country* received in return for this $256,453 20? They will furnish the answer. The country has received through the proprietors of this line, in the forms of freights and passage-money, a no less amount than $1,979,760 85, in cash; and, if the reduction in the prices of freight formerly paid to the British line be taken into account, nearly as much more, by saving the difference in freights and passage-money, to say nothing of the general advantages derived by all of our producing interests from the existence of this American line, which, as your committee believe, are incalculable. The money account will then stand as follows: government debtor $256,453 80, country creditor to $1,979,760 85, *in cash*; and if the former be deducted from the latter, the balance in favor of the country will stand $1,723,307 05, *in cash alone*, leaving out of view the duties on increased importations caused by the establishment of the American line.

The next line to which your committee would invite the attention of the Senate, is the line between New York and Chagres, via New Orleans, &c., established under a contract entered into with A. G. Sloo, his associates and their assignees.

The contract for this line was made on the 20th of April, 1847, to continue in force for ten years from the date of the commencement of the service. It provides for the establishment of a line of steamships, of not less than 1,500 tons burden each, to be built under the supervision of the government naval constructor and convertible into war-steamers of the first class, with engines of not less than 1,000 horse-power each; the contractors having the privilege, with the consent of the Secretary of the Navy, of making one of the ships of not less than six hundred tons burden. Two of the ships were required to be completed by the 1st of March, 1848, and the whole line to be in operation by the 1st of October, 1849. The service of these ships consists in transporting the U. S. mail

from New York to New Orleans, twice a month and back, touching at Charleston, (if practicable) Savannah, and Havana; and from Havana to Chagres and back, twice a month, with the usual provision for the accommodation of a lieutenant of the navy as commander and four passed midshipmen, in each ship; also an agent of the Post Office Department, free of charge to the government. This contract was transferred to George Law, Marshall O. Roberts and Bowes R. McIlvain, of the city of New York, on the 17th day of August, 1847. The annual compensation for full service is $290,000, and rateably for partial service.

This line, in conjunction with the line called the Pacific, or Aspinwall's line, between Panama and Astoria, in Oregon, constitutes the entire mail line from New York to Oregon, via the Isthmus of Panama, and will therefore be treated of in connection with it.

The vessels employed in this line are as follows:

| Names. | Tons & 95ths. | Commencem. of service. | Cost. |
|---|---|---|---|
| Falcon | 891 18 | Decemb. 1848 | $203,465 11 |
| Ohio | 2,432 23 | Septem. 1849 | 464,487 67 |
| Georgia | 2,727 42 | January 1850 | 464,487 67 |
| Crescent City | 1,291 00 | April 1851 | 206,250 00 |
| El Dorado | 1,049 88 | April 1851 | 154,000 00 |
| Empire City | 1,751 21 | May 1851 | 247,500 00 |
| Cherokee | 1,244 89 | May 1851 | 220,000 00 |
| Illinois | 2,123 65 | August 1851 | 440,000 00 |
| Philadelphia | 1,238 10 | October 1851 | 206,250 00 |
| Total cost of ships | | | 2,606,440 45 |

A tabular statement has been furnished, at the request of your committee, which is annexed to this report, showing the business of the line for six months, from *data* taken from the books of the concern. From this statement it appears that the total receipts, for the time named, amounted to $836,879 71, while the expenditures were $746,326 85; showing an excess of receipts over expenditures, of $90,552 86.

The Pacific branch, or rather continuation of this line, on the California and Oregon route, from Panama to Astoria, is the Aspinwall line, the contract for which was transferred, as before stated, by Arnold Harris, of Arkansas, the original contractor, to William H. Aspinwall and his associates, of the city of New York, on the 19th day of November, 1847.

The ships which at present compose this line, are as follows, the number of ships having been doubled in consequence of an increase

of the service, under a contract entered into under a law passed at the last session of Congress, changing the service from once to twice a month. The ships are:

| | | | |
|---|---|---|---|
| The California,..... | 1,058 tons, | commenced | October, 1848 |
| The Oregon,..... | 1,099 tons, | " | October, 1848 |
| The Panama..... | 1,087 tons, | " | Novem. 1848 |
| The Tennessee..... | 1,275 tons, | " | Novem. 1849 |
| The Columbia,..... | 778 tons, | " | Novem. 1850 |
| The Golden Gate..... | 2,068 tons, | " | Novem. 1851 |
| Total..... | 7,365 tons. | | |

The cost of the ships above mentioned, when placed at Panama, was as follows:

| | |
|---|---|
| The California cost..... | $210,953 00 |
| The Oregon..... | 208,031 00 |
| The Panama..... | 225,707 00 |
| The Tennessee ..... | 279,933 00 |
| The Columbia ..... | 162,920 00 |
| The Golden Gate ..... | 467,525 00 |
| Total cost..... | $1,555,069 00 |

It will be seen from the above, that the total cost of the six vessels which have been accepted by the officers whose duty it was to supervise them and decide whether they had been built in accordance with the requisitions of the law and terms of the contract and whose decision is presumed, by your committee, to be conclusive in the premises, has been $1,555,069, and that their aggregate tonnage is 7,365 tons, instead of 5,200 tons, the amount agreed for. In addition to these ships, as your committee are informed, the company has in the Pacific seven steamers, with an aggregate tonnage of five thousand tons, not yet accepted by the government. The additional steamers are, and have been, always kept ready to replace the mail steamers in the event of detention. The cost of these additional steamers has been, it is stated, about two-thirds of that of the accepted steamers of the same class, say about $1,036,712, making in all an outlay for steamships alone, of $2,518,337.

It appears that the whole number of passengers, of all classes, transported by the Pacific mail ship company, the line in question, previously to December 31, 1851, from Panama northward, has been 17,016, and from Oregon southward, 13,332. The prices of passage have constantly fluctuated, but, on the date above named, the 31st of December, 1851, the average rates were, for the first cabin, two hundred and twenty-two dollars; second cabin, one hundred and sixty dollars, and steerage, one hundred and seven dollars, between Panama and San Francisco. In the early stages of emigration the prices were increased, in consequence of

the enormous prices of labor and supplies on that comparatively unsettled coast, but were subsequently reduced. At the commencement of the undertaking, the company incurred, of necessity, vast expenses in the selection of proper harbors for taking in provisions, water, coal, &c., and in the construction of *depots;* and even at present, coal and supplies of every description are sent to the Pacific via Cape Horn, a distance of from thirteen thousand to fifteen thousand miles.

The freights from Panama northward, have been small in amount, and confined to the lighter descriptions of articles sent by express, while the mails have been very large, amounting in some instances to one hundred and fifty bags, each, and, together with coal, water, &c., occupying all of the space not required for passengers. From California, the freights southward, have consisted of treasure, amounting, it is supposed, to the value of seventy millions of dollars, but it is extremely difficult to compute the worth accurately, as a large portion of the gold, &c. sent, has been in the possession of passengers, and the value does not appear in the manifests.

From the data furnished to your committee, of an authentic character, it appears that the average expense of one of the steamers per voyage, from Panama to San Francisco and back, is $68,442, independently of the insurance, which amounts to fifteen thousand dollars, upon each steamer, per annum, making an aggregate of ninety thousand dollars a year, for the six steamers. The entire mail pay for this route being $348,250 per annum, and the number of voyages being twenty-four, it follows that the compensation received by the company for carrying the mails is $14,510 for each voyage and, the expense per voyage being $68,442; if the receipts for mail carriage be deducted from the expense incurred, the balance against the company will be $53,932. It should be borne in mind, that the expenses here charged are for the voyage between Panama and San Francisco and consequently do not include those between San Francisco and the ports northward, in Oregon, where the travel is comparatively very small, and pays only an insignificant proportion of the expenses incurred in running the mail steamers. It should also be stated that the amount of expenses here set forth, applies to the Tennessee, Panama, Oregon and California, but not to the Golden Gate, which, being a much larger vessel, is navigated at a much greater cost. If the monthly insurance on the vessels engaged in making the voyage each month between the two *termini* of the route be included, the expense of each voyage will be increased, and the excess of cost, over compensation for mail service, will of course become greater.

It appears from an examination of the returns of the Post Office Department, that the amount paid for mail transportation throughout the whole of the California and Oregon line, that is to say,

from New York to Chagres, and from Panama to Astoria, has been $1,607,087 90, while the receipts from postage on the same route have been but $930,478 94; showing a balance against the department of $676,608 96. This deficiency, however, has not been caused by any fault whatever, on the part of the contractors, who have, as the committee think, performed their duty with the greatest zeal and correctness. The true cause of the deficiency is to be found, it is believed, in the law which, as it stands, does not provide that the agents of the department, or those of the contractors, shall have authority to make such examinations into the packages and parcels sent through individuals and express lines, as shall enable them to detect and pursue to punishment, the enormous frauds systematically practised every day upon the government.

## JOURNAL OF INTERNAL IMPROVEMENT.

### Railroad from St. Louis to New Orleans.

### Missouri and Arkansas Railroad.—U. S. Survey, &c.

The Report of the Survey of a route for a railroad from St. Louis, Mo., to Red River, at Fulton, Ark., by Joshua Barney, U. S. Agent, has just made its appearance from the seat of Government.

Without speculating on the policy of the vast measure, which prompted this survey, the practical information contained in the report is of great value to the States of Missouri and Arkansas.

Our aim, in this article, will therefore be, merely to indicate the line, condense the substance, and represent the items of main importance in the survey, with a local view—with a view of promoting the cause of Internal Improvements in Missouri and Arkansas,—co-operating with Louisiana in forming a junction by railroad from St. Louis to New Orleans, although we prefer our original project —the cheapest and shortest route *via* Helena; the distance being reduced by the short line to 650 miles, which by the river is 1200 miles.

The report begins with a description of a futile effort to take a course from the city of St. Louis, bearing to the West of the Iron Mountain, with the intention after crossing the valley of the Maramac, to ascend the ridge between Big river and the Mississippi, and to pursue the same to the source of Big river, near the Iron Mountain, with the hope of discovering a favorable route along some stream having its source near the Mountain, flowing to the Big Black river. Difficulties of a very serious nature were met with on the crest of this ridge. It was exceeding tortuous; deep indentations of the ravines on each side frequently interlocked each

other; it was a succession of knobs and depressions. "Ascents and descents were encountered, over which grades of seventy, eighty and ninety feet per mile could only be attained by very expensive excavations and embankments."

The description of this unsuccessful effort terminates as follows:

"A route for a railroad on this ridge would be impracticable; for if it were possible to attain the elevation without the aid of inclined planes, it would be found useless to attempt to follow its sinuosities by a proper system of curvatures."

After the relinquishment of this first attempt, a proposition to discover a ridge route west of Big river, seems to have been considered, but was disposed of on the presumption that it was liable to the same objections that existed against a ridge route on the East of this river. Morell's survey, in 1840, for a railroad from St. Louis to the Iron Mountain, is alluded to as indicating similar objections, and as being exceedingly circuitous, the distance exceeding 110 miles.

We would here state that the Pacific Railroad Company have a party now engaged in the survey of a branch road to the Iron Mountain, on the ridge west of Big river; and we hear the prospect is much more flattering than was anticipated. This branch will bear fruits of incalculable importance to Franklin and Washington counties, as well as to the company, and we hope to see it completed as soon as it can possibly be done.

But to return to the report. After the attempts to discover the ridge routes were abandoned, it was thought that a route along the west bank of the Mississippi, and the valley of the Platten creek, afforded the greatest facilities, and presented the most direct line, as far as the neighborhood of the Iron Mountain, on the course proposed for the road.

Capt. Barney then states his reasons for the selection of this route somewhat at length, designates the southeast corner of the Arsenal grounds, as the point from which the survey commenced, and gives as the base line of his operations the high water mark of the Mississippi, in June, 1844, remarking that the total distance from St. Louis to the Iron Mountain, by this route, would not exceed 76 miles. He says:

"I accordingly commenced the survey of this route on the 6th of November 1849, at the southeast corner of the coping of the wall which encloses the U. S arsenal near St. Louis, and continued on it till the 26th of February, 1850, terminating in the valley of the St. Francois, at a point on the right bank of the stream, seventy-three miles and three hundred and sixty feet from the point of commencement, having made also numerous experimental offsets from the main route.

"I would further state, that in making a selection of this route for the then contemplated survey, I was influenced by a desire to pass, if possible, on the east of the Iron mountain, and thereby avoid crossing the additional summits which would necessarily be encountered on any route passing to the west of it. These summits, too, would, it was supposed, be found of much greater altitude, the further the route should be inclined to the west; and where the chain of Ozark mountains, and the range of hills thence towards the Iron mountain, traverse the country, they would be found to present obstacles which would be very difficult to surmount.

"The valleys of either the St. Francois, Big Black, or Current river, must necessarily be availed of, for a road in connexion with the route via the Mississippi and Platten creek. They all flow in a direction favorable for the contemplated road. The two latter, uniting in Arkansas near the northern boundary of the State, take a course thence to the junction with White river, nearly direct towards Little Rock.

"To arrive at the source of either of these two last-mentioned rivers, however, a considerable detour must be made, after gaining the valley of the St. Francois, which would not only increase the distance very materially, but would make it necessary to cross in one case one, and in the other two additional summits.

"The valley of the St. Francois appeared to present the most direct route; for though very serpentine in its course, it does not appear to differ, in this respect, from the valleys of Big Black or Current river. It is purposed, therefore, to continue the route down the valley of the St. Francois, until a favorable opportunity is afforded to cross to Big Black or White river, and thence by the most feasible route to the Arkansas above Little Rock.

"It was supposed, at the time I made the selection of this route for the survey, that no ridges or very elevated land would necessarily have to be crossed, in passing from the St. Francois to Big Black or White river; and I have been subsequently informed by several individuals who were well acquainted with that section of the country, that the land is low, and no obstacle whatever will present itself to the passage of the road.

"A branch road to the Iron mountain might diverge from this route, where it enters the valley of the St. Francois, and ascend, by the valley of one of its head branches, to the base of the mountain. The length of this branch road would be about fifteen miles, and the total distance from the mountain to St. Louis would not exceed seventy-six miles

"The developments made by this survey may be considered of great importance, in this point of view; as I believe no route from St. Louis to the valuable and inexhaustible masses of iron ore, and other minerals, in this section, has ever been contemplated, which would not exceed one hundred miles in length.

"The elevation of the water at the great freshet of the Mississippi of June, 1844, was ascertained from a mark made at the arsenal. This level has been assumed as the base line, and the surveys have been made with the view of locating the road and establishing the grade beyond the reach of similar freshets.

"The average fall of the Mississippi, from St. Louis to the mouth of Platten creek, will not vary much from six inches per mile; and this inclination may, I think, be safely assumed, in establishing the grade of the road, with reference to the effect of freshets. Observations were taken with the level at different points between the arsenal and the mouth of Platten creek, to marks made at the extreme height of the freshet of 1844, by which I was enabled to determine the fall.

"The stage of water in the river changed so often whilst the survey was being made along its banks, as to render it impracticable to arrive at any *certain* estimate of the fall at low water.

"Though this survey may be considered as entirely experimental, an effort has been made to approach sufficiently near a location to enable me to furnish an approximate estimate of the distances, gradients, curvatures, and probable cost of construction."

Having disposed of the preliminaries, we would here indicate the line of the route. It continues along the western bank of the Mississippi to the mouth of the Platten creek, to its source, crosses Terre Blanc creek a few miles above its junction with Big river, crosses the St. Francois river at a point 3 miles south of Farmington, St. Francois county, and 15 miles east of the Iron mountain, continuing along the valley of the St. Francois river, passes Greenville, in Wayne county, and extends along the river to a point 145 miles from St. Louis, "near a place known as the old Indian Ford, where the hills begin to recede from the river, at the termination of the highlands between the St. Francois and Black river."

Here the line leaves the valley of the St. Francois, and enters "what is termed the Swamp District, a section of country which has been very little explored, except by those who are in the habit of hunting." The line being continued for a distance of nearly 15 miles, passes "over some ground a little more elevated than the general level of the swamp, and known as the Ash Hills."

About 5 miles further south, it crosses Monockolet slough, thence deflecting S. W. pursues a straight course, 10 miles of which are in Missouri, and passes, along the ridge between the Cache and Black river, near Pocahontas.

As this portion of the route has generally been considered the most impassable on account of an apprehension that immense and deep lakes were lying in the way, we will quote more freely the words of the report, hereafter, on the subject of gradients and estimates.

Taking up the line of the route again, at a point on the ridge between the Cache and Black river, near Pocahontas, it extends on or near the middle of the ridge, in a southwesterly direction, without any material deflection, crosses White river just below the mouth of Black river, about ¾ of a mile from Jacksonport, continues its course in the same direction, "crosses Little Red river, at the farm of Americus Vanmeter, about two miles below Prospect Bluffs," "passes to the North of Col. Bracy's cotton plantation," "through the improvements of Alexander Crawford, John Griffins, Dr. Waters" and others, over "the road from the post of Arkansas to Fort Smith, on the farm of John M. Bell, Esq.," over "the main road from Little Rock to Searcy and Batesville, near the summit of one of the ridges on the farm of Taylor Whitley," over "the road leading from Little Rock to Memphis, on the farm of Redick Eason, about 14 miles by said road from Little Rock," and over the Arkansas river, "about 3 miles below Little Rock."

The line from the southern boundary of Missouri to Little Rock is so direct, and the obstacles in the way of a railroad route so trifling, that Capt. Barney thinks "it is more than probable that a straight line" from the boundary to "a depression in a spur of hills," a few miles north of Little Red river, "would pass over ground quite as favorable for the construction of a railroad as that over which the survey was made. This would make 100 miles in one right line."

Capt. Barney also states that "the route could be so altered as to run in a direct line" from the point above mentioned (where the spur of the high land was touched) to a suitable place for crossing the Arkansas river; which would be about 1¾ mile above the point at which the survey was crossed."

This would make 50 miles more in one right line.

The railroad would then be only 1¼ mile from Little Rock, and Little Rock would then be only 335 miles from St. Louis.

Resuming the line of the route, starting "from the end of an

offset, distant about 250 yards west of the residence of James Keates, Esq.," it ascends the valley of Fouche Bayou, crosses the dividing ridge between it and Hurricane creek, near the house of J. H. Crease, Esq., crosses the valley of Hurricane creek, "about ¼ of a mile from the point where the road from Little Rock to Washington and Fulton crosses it," thence passing near Benton, "about ½ mile to the right of the line," crosses Saline river "about 200 yards south of the ford on the Little Rock and Fulton road," passes out of the Saline valley, "near the house of Benj. Clardy, Esq., where it crosses the road from Camden to Little Rock," enters the valley of the Ouachita near the house of Commodore Perry Brewton, about 2 miles from Rockport, passes along this valley, and crosses Ouachita river near Arkadelphia, about 400 miles from St. Louis, and continues its course nearly direct to Fulton, making the whole distance from St. Louis 460 miles.

The line from Arkadelphia to Fulton crosses the road from Arkadelphia to Washington, near the house of widow Hurd, passes through Graham Manning's cotton plantation, crosses the Little Missouri about 200 yards below Elkin's Ferry, strikes the cotton plantation of Col. Thomas Williamson, where it crosses the road from Washington to Camden, crosses the road from Spring Hill to Washington, on the farm of Mr. Sitzer, over the plantation of Mr. Poindexter, and strikes Red river at the upper part of Fulton.

Capt. Barney indulges in very few speculations or descriptions about the fertility of the soil or the wealth of the mines along the line; he seems to have been mainly absorbed in the determination of the ascents, descents and deflections along the route. Passing by Carondelet, Jefferson Barracks, mouth of Maramac river, Herculaneum, close along the western bank of the Mississippi river, into and along the valley of Platten creek, and on to a point on the St. Francois river, 15 miles east of the Iron Mountain, he sums up the quality and products of the soil from St. Louis to the Iron Mountain in the following paragraph:

"The Bottom lands along the Mississippi and the valleys of the streams, over which this route extends, are covered with fine timber, consisting of varieties of oak, hickory, walnut, ash, sycamore, &c. But a small portion of the land has been cleared for cultivation, though the soil is exceedingly fertile, particularly on the flat lands of the valleys."

He states that the rock encountered along this route is generally limestone, that "the lead-bearing rock is found in places along the valley" of the west branch of Platten creek, and "great quantities of iron ore in boulders and broken fragments were seen in the bed of the creek and scattered about the surface of the ground." "The excavations necessary for the construction of a railroad through this region, therefore, may make important developments," and further states that "iron ore, of the same character as that found in the valley of the west branch, abounds in the valley of the middle fork of the Platten also; and beautiful specimens of crystalized quartz, encrusted with iron ore, were picked up on the hill-

sides and bottoms;" and adds that near the summit between Platten and Terre Blanc creeks "the ore was found in place, where large masses exist, combined with flint. It is supposed that the ridge or spur is here composed entirely of ore."

On the banks of the St. Francois river, about 15 miles east of the Iron Mountain, 3 south of Farmington and 64 from St. Louis, the first division of the route terminates.

But Capt. Barney remarks that, at a short distance below this point, "granite rock appears on this bank, where the lime-rock terminates; after which granite and sandstone, of very superior qualities for building, occur alternately. Sandstone cliffs occur in several places along the margin of the river, on the right bank, varying from 10 to 35 feet in height. On the left bank there appeared to be a continuous range of granite."

The second division of this route, 81½ miles in length, though only 60 in a direct line, passing within about 8 miles of the Pilot Knob and by Greenville, extends from one end to the other along the St. Francois river; the extra length occasioned by the necessities of following the sinuosities of the river.

Capt. Barney sums up the description of the country along this division in the following three paragraphs:

"But very little of the land in the valley of the St. Francois is cultivated. What has been, appears in patches of from ten to fifty acres, interspersed along the route at intervals varying from half a mile to six or eight miles. The soil is generally very fertile; but little wheat, or grain of any kind, except corn, is raised in the country. The attention of the farmer appears to be turned principally to raising stock, such as cattle, horses, hogs, and mules. I saw but few sheep on the route; and the country is also very thinly settled, remote from the river.

"The rock which has been mentioned in the description of the various sections of the second division, and which is found in abundance throughout the whole extent of the valley, is of an excellent quality for building purposes; the sandstone and granite which are found on the 1st section, and the granite which extends thence to the end of the 2d section, are of a very superior quality, and can be split out to any size and shape that might be required.

"The timber is generally of a very large size in the valley. On the 1st section there is a considerable quantity of pine intermixed with the other trees of the forest. The varieties of oak, hickory, ash, elm, &c., are found along the whole extent."

The third division of the route extends from Old Indian Ford on the St. Francois (30 miles above the southern boundary of Missouri and 145 from St. Louis,) 65 miles, passing Pocahontas on the ridge between Cache and Black river, and terminates about 10 miles below. Pocahontas is thereby brought within 200 miles of St. Louis.

The fourth division of the road, 62½ miles in length, extends to a point north of and near Glaize creek.

After alluding to some "hills in which both lime and granite rocks occur," near the Departee Bayou, some ponds, several sloughs and a few bottoms subject to inundation, Capt. Barney says:

"The general character of the 4th division is, in most respects similar to that of the 3d division; and the two embrace all that portion of the swamp district traversed by the line."

"The timber on this division is very much the same as that on the 3d division, though the cane which has been found at intervals along the line, from the 1st section on the 2d division, has gradually increased in size, and on the 4th section of this division become quite an impediment."

From the Old Indian Ford on the St. Francois to Jacksonport, on the White river, from August 16th to September 27th, 1850, no running water was found, except while the party was one week along Black river. "During the latter three weeks the only water which could be procured" was "scooped up out of holes and puddles found in the beds of drains, and where trees had been uprooted by the winds."

The 5th division extends to Little Rock, 64 miles, 336 miles from St. Louis.

Between Glaize creek and Little Red river the line touched spurs of hills which appeared to be one mass of sand rock for several miles, varying in altitude from 30 to 100 feet, though "the ground over which the route passes, is entirely free from stone of any kind."

Capt. Barney, after remarking that the country in this division is more diversified in its general character than that of the two preceding divisions, condenses his description of it, as follows:

"The country from one extreme to the other of this division, with very little exception, is covered with a large growth of forest trees, which consist of the varieties of oak, gum, ash, maple, hickory, elm, &c., with underbrush and green briar. In the swamps and bottom lands the cypress and willow oak predominate.'

"Very little cultivated land was crossed by the route in this section. Improvements are sparse, and only exist in the immediate neighborhood of the larger streams, and at intervals along the principal roads."

"At the time the survey was made, there was no running water in any of the streams crossed in this division, except Little Red river. Many of the water courses were completely dried up, and in most of the others, water was only to be found in stagnant pools, in the beds of the stream."

"This division embraces a district of country in which the culture of cotton has been introduced and may be considered the principal staple commodity. The article produced is of fair quality."

The 6th division extends to the Ouachita river, near Arkadelphia, 65 miles, about 400 miles from St. Louis. The country here becomes still more varied with valleys of clay loam, bottoms subject to be inundated by freshets, uplands, hills and ridges composed principally of loose and compact gravel and sand, and several small streams. Rock is found only in few instances. But Capt. Barney says:

"The hills bordering the valley of Fouche bayou are very high, and those on the right of the stream appeared to be one mass of granite. There is an isolated hill within four miles of the Arkansas on the right bank of Fouche, called the Iron mountain, which rests on a base of granite of very superior quality for building, from which blocks of any dimensions can be obtained. This hill rises to an elevation of between 200 and 300 feet.

"The route passes through a few farms on the ascent from the Arkansas to the summit of J. H. Crease's, and through two or three in the section between that point and Saline river; but the extent of cultivated land is very inconsiderable.

"Besides the varieties of oak, hickory, ash, elm, &c., there is an inexhaustible quantity of very superior and large yellow-pine timber on the whole extent of the district embraced in this division."

The 7th division extends to the termination of the survey at Fulton on Red river, 60 miles, making the whole distance from St. Louis to Fulton 460 miles.

In regard to the features, soil, products, and improvements of the country, Capt. Barney says:

"The route, though very direct from the Ouachita to Fulton, crosses the numerous ridges, with very few exceptions, at very favorable points where there are depressions, from which small runs or drains flow into the branches on one or both sides of the ridge. This was in a great measure accidental, as it could not have been supposed that so many depressions of this nature could come in contact with a straight line for such an extent.

"The soil in the valleys and bottoms in this district consists of a light loam. In the valley of the west branch of the Deciper, on the right of the stream, about half a mile to the right of the line, on the plantation of Michael Bozman, numerous marine shells appear in the soil and on the sides of the hills; and in the bottom of a small run exists a large bed of marl.

"The hills are composed of compact and loose gravel and sand generally; though between the Ouachita and Little Missouri rivers a stratum of stiff blue and red clay appears about the base of the hills, and where the banks are washed by the waters of the creeks.

"The staple commodity of this district is cotton; but it is not cultivated to any great extent, as the improvements are very sparse."

As we will hereafter present the aggregate costs of construction of this railroad, the main items of information, with considerable detail, we will present here only a few of the most extraordinary lines of ascent, descent and deflexion along the route.

The road from St. Louis to Platten creek, 27 miles, is nearly level, inclining with the natural descent of the river 13,5 feet.

From Jefferson Barracks to the valley of the Maramac the course curves gradually, the radius seldom less than 1.800 feet.

From the mouth of Platten creek to St. Francois river near the Iron Mountain, 37 miles, the road ascends to 425 feet above the base line, though the highest point of the road is on the summit level between the waters of Big and St. Francois river.

This point is 550 feet.

The most difficult ascents, descents and gradients from the Mississippi to St. Francois river are:

1st. About 15 miles from the Mississippi the total ascent would be 155 feet, overcome by gradients as follows:

| | | | |
|---|---|---|---|
| 9,000 | feet at | 5.86 | feet per mile, |
| 9,000 | " | 11.73 | " |
| 12,000 | " | 12.10 | " |
| 15,000 | " | 21 12 | " |
| 6,600 | " | 34·00 | " |

2d. About 3 miles further (at the entrance of the proposed tunnel of 2,200 feet in length) the ascent will be 280 feet, and overcome by the following gradients:

| | | | |
|---|---|---|---|
| 9,000 | feet at | 39.6 | feet per mile, |
| 7,800 | " | 69.48 | " |
| 6,000 | " | 96.80 | " |

making the elevation attained, 435 feet.

This is the section in which mineral was found in the greatest abundance, and the report states that "it is supposed by the most

intelligent inhabitants of this section, that the ridge through which the tunnel is proposed to be made, abounds in galena and other valuable ore."

3d. From this point, Capt. Barney returned to the end of last section, and continued up a valley of the middle fork of Platten, over 2½ miles. He says: "The ascent on this section would be 230 feet; gradients 8,400 feet at 66 feet per mile; 5,100 feet at 129.-43 feet per mile."

4th. Continuing nearly 3 miles further at the summit of Platten and Terre Blanc creeks, the ascent is 105 feet, overcome by the following gradients:

3,300 feet at 72.00 per mile.
3,000 " 8.00 "
7,800 " 37.23 "

Iron ore, and beautiful specimens of quartz encrusted with iron, were picked up along this section.

5th. The road here descends 165 feet to Terre Blanc creek, about 4 miles. The gradients 12,000 feet at 26.83 feet per mile; 7,500 at 73.21 feet per mile.

6th. The road ascends from Terre Blanc creek, passing the farm of Richard Paston, Esq., and the State road from St. Louis to Farmington, to the summit level between Three Rivers creek and Wolf creek, about 5 miles.

The ascents in this section would be 225 feet; the gradients—

11,400 feet at 23.15 feet per mile.
6,000 " 44.00 "
8,700 " 74.70

attaining an elevation of 550 feet above the base line.

This point, the highest point of the whole road, is 30 miles from the Mississippi river, and 57 from St. Louis. From this point, with a comparatively gentle descent, ascent and descent, the road continues 7 miles and strikes the St. Francois river.

Capt. Barney concludes his report of gradients on this 1st division of the road with saying:

"By a skilful and judicious location, the work in many places may be made lighter, and the gradients less.

"The tunnel will not exceed 2,400 feet in lenght, which at an estimate of $20 per foot, will amount to $48,000.

"No other difficulties (excepting the bridge of the Maramac and the tunnel of the Platten ridge,) of an unusual nature occur on the whole route surveyed; and the road, thus far, can be graded at an expense much below the average cost of grading on railroads already constructed in this country.

"There will be a very small portion of the road straight; but the curves are not of radii to make them very objectionable; it being found necessary, but in a very few instances, to make the radius less than 1,800 feet, and never less than 1,0 0 "

The second division of the road extends to Old Indian Ford, 81 miles, 145 miles from St. Louis. This division which would have been only 60 miles in length in a straight line, is made 21 miles

longer on account of the numerous curves in the river, which it was thought necessary to follow, mainly, throughout the whole length of the division.

The road descends, with a moderate inclination, interrupted by only 5 ascents, from 425 feet above, to 80 feet below the base line.

It will be unnecessary to repeat here any of the gradients of this division, not one of them being so steep as several are in the first division, of which a full account is given above.

The descent in the stream was found to be 508 feet from the point where it was first crossed to Indian Ford, and, therefore, to exceed the main descent of the road only 3 feet.

This division will be more expensive than the other, because 1st, it is ¼ longer; 2d, it crosses the river right and left several times; 3d, bold cliffs of granite and trap rock project in the way of the road.

About 75 miles from St. Louis the road passes through "*The Narrows of the St. Francois.*" At a point, 15 miles further down, "the river flows through another narrow pass confined on each side by high, steep hills and precipices of trap rock, which in places rise perpendicularly from the margin of the stream to an altitude of 150 feet." "The river makes numerous abrupt turns, making it necessary to cross it no less than 9 times" within as many miles.

100 miles from St. Louis, at the farm of Mr. Crauns, the hills "appear isolated mountains." Here advantage was taken of a depression along the bank, the valley of the St. Francois was left, and that of Big creek entered; but, although "4 or 5 miles and as many bridges are saved by this detour" which extends 8 miles, Capt. Barney reports:

"A portion of the valley of Big creek, traversed by the route, is of the same character as that of the valley of the St. Francois described above; the hills rising on each side, in a succession of perpendicular cliffs of trap-rock, to an elevation of six or seven nundred feet."

Along the section passing Greenville, 120 miles from St. Louis, "the valley is more extensive, and the greater portion of the route would pass over bottom lands," and continues the same with slight variations at singular spots to the end of the division, these variations being mainly at an acute angle pointing northwest, called "The Whirlpool," and "The Neck," 600 yards wide, "the distance around which by the river, would be about 3 miles." These phenomena are about 5 miles apart, and within 10 miles of Old Indian Ford, the end of the 2d division.

From Old Indian Ford, the road runs south 20 miles nearly on a level, crossing "Ash Hills" and Monockolet slough, then running towards the Southwest 10 miles further, on the same level, it crosses Big Swan lake, "in which there was no water," and the boundary line between Missouri and Arkansas, at nearly the same point. From this point it continues southwest to Little Rock, 160

miles in a line almost uniformly straight; 90 miles of this portion of the road, is on nearly the same level with the last 30 miles in Missouri. So that from Old Indian Ford, this road descends gently (with only five extremely slight ascents) 120 miles to Glaize creek, about 8 miles S. W. of Jacksonport. While indicating the line of the route through the "undiscovered country," we proposed to make several extracts from the report of the 3d division terminating near Pocahontas. Here they are:

"We thence (from Ash Hills) continued S. 7 W., about three miles, crossing the Monockolet slough, which heads near the St. Francois, and extends, in nearly a southwest direction, to Black river. The bed of this slough might be availed of to a great extent in cutting a canal from the St. Francois to Black river, which could be done at a very little expense."

"The left or southeast bank of the slough is much more elevated than the general level of the swamp, and is never overflowed by the inundations of the river, as the greater part of the surface of the country appears to be in times of freshets. After crossing the Monockolet slough, the route continues for a distance of ten miles, in a southwest direction on ground not subject to be overflowed."

"The line crosses Big Swan Lake, which was represented to be one of the sources of Cache river. At the time the line was run, (August 31st, 1850) there was no water in the lake, and the bed of it was covered with a thick growth of swamp weeds and grass; the bottom of it a deep quagmire."

"The beds of Mud creek, Blue Spring Slough, at two stations, and the Monockolet Slough will require bridges of 30, 20, 60, and 75 feet spans respectively; and seven small runs or drains of inconsiderable extent will require culverts. It may be found expedient, too, in crossing several of the cypress sloughs, (through which, however, there did not appear any evidences of the water having at any time formed a current,) to construct the road on piles, so as to allow the water to drain off, where there is an inclination from one side of the road to the other. With these exceptions the road may be constructed by forming an embankment, averaging say not more than four feet in height for the whole length of the division."

From the information above afforded, and from much more that follows, it is clearly manifest, that for the distance of 65 miles along the line surveyed from Old Indian Ford on the St. Francois in Missouri, to Pocahontas, in Arkansas, a railroad can be built at a very cheap rate. We now know that, where great obstacles were apprehended, only small ones exist.

We are particularly pleased to remark here, by way of digression, that Capt. Barney's report confirms the statement of Prof. Forshey, of La., published in our May No., in regard to the features of the ground in this *terra incognita;* also of Dr. King of Mo., published in our June No., on the same subject; also of an

Ex-member of Congress, published in our July No.; each of the above contributors advocating the project proposed originally, in our February No.—*Railroad from St. Louis to New Orleans.* As this "undiscovered country" has been a subject of groundless misrepresentations, and as Capt. Barney is both diffuse and explicit in his fair representation of its appearance, we cannot refrain from quoting a few more consecutive paragraphs from his report of this section of 65 miles.

"Though the surface of the country through this district is gently undulating, in places there is a gradual inclination to the south. The total descent in the division of sixty-five miles is sixty feet, on which the gradients of the road will in no instance extend ten feet per mile. There will be three slight ascents to avoid cutting where the general surface of the ground is level, but these ascents are but short, and do not exceed five feet per mile.

"The soil is generally a clay-loam, resting on a bed of blue clay, through which the water in the rainy seasons of the year does not percolate rapidly; and as there are sections, for miles in extent, where the elevations on the surface do not vary more than a few inches, the water remains on the surface and saturates the soil, so that the district becomes impassable. Hence, I imagine, it has acquired the name of the swamp district. The line of survey crosses very few morasses or grounds of a swampy nature, and these are of very inconsiderable extent, requiring nothing more than the usual method of embankment to cross them.

"In locating a road with a view of making it as straight as possible, it is probable that the route might pass over the beds of some few small ponds, as they are interspersed over parts of the northern portion of this division: but the embankment in these cases would be comparatively light.

"No stone, whatever, is found on the route, and that which may be required in the construction of a road must necessarily be brought from the bank of Black river.

"The timber is generally of very large size, consisting of the varieties of oak, hickory, ash, elm, sweet gum and maple. In the sloughs and low swampy grounds, there is a mixed growth of cypress and cupola gum. The underbrush is very thick, except on the ranges of flat glade lands, where there is generally a growth of post and willow oak, and hickory of a small size."

The 4th division of this road, 62 miles, ending near Glaize creek, is on an almost uniform level until near its termination. The table of estimates, which follows, makes this division the cheapest one in the whole route.

The 5th division, 64 miles, extending to Little Rock, is somewhat more varied in its gradients than either of the two preceding, though the cost of its construction is estimated to be lower than that of the 3d, and higher than that of the 4th.

The 6th division, 64 miles, extending to the Ouachita, and the 7th division, 60 miles, extending to Red river at Fulton, are varied by numerous ascents and descents though with few deflexions. The ascents and descents in the 6th and 7th divisions resemble those in the 1st and 2d divisions though they are overcome at less expense.

The total fall below the base line at Little Rock is 160 feet, at the Ouachita 213, and at Fulton 169 feet.

The estimates of the cost of construction of the several divisions are as follows:

Estimates of 1st division, 64 miles, from the city of St. Louis to the St. Francois river:

| | | |
|---|---|---|
| Total cost of clearing and grubbing | | $44,685 |
| Do. | excavation and embankment | 563,370 |
| Do. | masonry | 97,721 |
| Do. | bridging | 67,220 |
| Total cost for grading and bridging | | 772,996 |

Estimates of 2d division, 81 miles, along the valley of the St. Francois river to Old Indian Ford:

| | | |
|---|---|---|
| Total cost for clearing and grubbing | | $56,040 |
| Do. | excavation and embankment | 680,857 |
| Do. | masonry | 114,449 |
| Do. | bridging | 206,150 |
| Total cost for grading and bridging | | 1,057,496 |

Estimates of 3d division, 65 miles, to a point 10 miles below Pocahontas:

| | | |
|---|---|---|
| Total cost for clearing and grading | | $62,400 |
| Do. | excavation and embankment | 322,130 |
| Do. | masonry | 18,480 |
| Do. | bridging | 12,350 |
| Total cost for grading and bridging | | 415.360 |

Estimates of 4th division, 62 miles, to Glaize creek:

| | | |
|---|---|---|
| Total cost for clearing and grubbing | | $56,340 |
| Do. | excavation and embankment | 182,389 |
| Do. | masonry | 28,888 |
| Do. | bridging | 92,550 |
| Total cost for grading and bridging | | 360,167 |

Estimates of 5th division, 64 miles, to Little Rock:

| | | |
|---|---|---|
| Total cost for clearing and grubbing | | $49,590 |
| Do. | excavation and embankment | 223,357 |
| Do. | masonry | 39,733 |
| Do. | bridging | 61,700 |
| Total cost for grading and bridging | | 374,380 |

Estimates of 6th division, 64 miles, to the Ouachita river:

| | | |
|---|---|---|
| Total cost of clearing and grubbing | | $54,450 |
| Do. | excavation and embankment | 340,718 |
| Do. | masonry | 105,427 |
| Do. | bridging | 193,570 |
| Total cost for grading and bridging | | 694,165 |

Estimates of 7th division, 60 miles, to Fulton:

| | | |
|---|---|---|
| Total cost for | clearing and grubbing | $51,690 |
| Do. | excavation and embankment | 454,800 |
| Do. | masonry | 110,695 |
| Do. | bridging | 69,500 |
| Total cost for | grading and bridging | 686,685 |

Aggregate cost of construction:

| No. of division. | Description of work. | Amount. |
|---|---|---|
| 1 | Clear'g & grubb'g, grad'g, mas. & bridg'g | $772,996 |
| 2 | Do. do. do. do. | 1,057,496 |
| 3 | Do. do. do. do. | 415,360 |
| 4 | Do. do. do. do. | 360,167 |
| 5 | Do. do. do. do. | 374,380 |
| 6 | Do. do. do. do. | 694,165 |
| 7 | Do. do. do. do. | 686,685 |
| Cost of constr., with iron rail (65 lb p. yard) with necess. sidlings & switches—460¾ miles, $7.500 p. m. | | 3,455,625 |
| Cost of engineer department and contingencies | | 500,000 |
| | | 8,316,874 |

As the cost of construction of depots, station and engine-houses, workshops, &c., must depend upon the nature and extent of the business on the road, no provision has been made for them in the above estimate.

The calculations have been made for a road-bed 26 feet wide.

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Thus, we have presented a plain view of the chief points in the report of this survey. We have endeavored to unfold all the material facts in the case, equally plainly, to the plainest man and to the most skilful.

We trust this practical information may be turned to immediate account, and result in astonishing utility.

We hope that all who feel an interest in the cheapest and shortest *Railroad from St. Louis to New Orleans*, only 650 miles, *via* Helena and the *New Orleans, Jackson and Great Northern Railroad*, will take advantage of this survey of 175 miles in that direct route from St. Louis to the southern boundary of Missouri;—that all who feel an interest in a *Railroad from St. Louis*

*to New Orleans via* Little Rock in Arkansas, and Monroe and Alexandria, in Louisiana, and the *New Orleans, Opelousas & Great Western Railroad*, will make use of this survey of 336 miles on that route;—that all who feel an interest in the internal improvement of Missouri and Arkansas,—in their mountains of iron and lead,—in their valleys of corn and cotton,—will catch at this survey of 460 miles,—that all men within their borders will be firmly united in favor of the *Missouri & Arkansas Railroad*;—that the whole North, South and West may be invoked to rally to the aid of these rich, poor States; so that when the "Bill" arrives at its goal in Congress, 10 miles of land, on each side, and in favor of this road, may be granted by an overwhelming majority; and finally, we hope that the whole road may be put under contract before next spring.

## PACIFIC RAILROAD.—First Locomotive West of the Mississippi.

The "Pacific No. 3," arrived at St. Louis about the 20th ult. We learn from the officers of the Pacific Railroad Company, that the weight of this engine is 22 tons; cost at the manufactory, Taunton, Mass., $7,600; total charges on transportation, including insurance, $1,400.—The "St. Louis, No. 1," manufactured at Patterson, N. J., arrived about the 15th inst. (Sept., 1852); weight 24 tons, cost $8,500, at the manufactory; cost of transportation, including insurance, about $1,500.—The "Maramac No. 2"—the largest and most elegant engine—manufactured by Rogers, Ketchum & Grosvenor, at Patterson, N. J., costing $8,600 there, is now on its way here.

The company have also received two passenger cars, manufactured at Troy, N. Y. Each of these cars affords accomodation for about sixty persons, and costs $2,300, at Troy. Cost of transportation &c. above $300 each. We are informed that the company have received about 3,200 tons of iron rails, purchased in London, which has cost about $45 per ton delivered at the Depot in St. Louis.

The cost of rails, delivered at New Orleans, exclusive of import duty, *per* contract, is $32,25 *per* ton. By the contract 4400 tons of rails were to have been delivered at New Orleans, on the 15th of Sept., 1852. 1200 tons of rails are therefore now prob-

ably *in transitu* from New Orleans to St. Louis. The rails weigh 60 pounds per lineal yard. 95 tons extend one mile, excluding occasional side tracks.

The company will hereafter build their own cars, having engaged one of the best car makers in the United States.

On the 20th of September the company commenced laying the rails on the tracks, and will continue the work till forty miles are finished.

In the 1st number of the next (9th) volume, we hope to publish a valuable article on the subject of the *Pacific Railroad.*

## ALTON AND SPRINGFIELD RAILROAD COMPLETE.

This road was opened for travel on the 9th instant, on which lay the first locomotive and train arrived at Springfield. Scarcely any railroad in the United States, of equal length—72 miles—has been built in so short a time. In respect to enterprise and indomtable energy, Alton stands unrivaled among the towns on the Mississippi if not in the Union. We trust her citizens will be fully compensated for their public spirit.

## BELLEVILLE AND ILLINOISTOWN RAILROAD.

We learn that on the 25th ult. (August, 1852) Messrs. Page and Bacon, Bankers of this city, subscribed for the entire stock in this road, and entered into a contract to have the same in successful operation by the first day of August, 1853.

## HANNIBAL AND ST. JOSEPH RAILROAD.

The President and Directors of the Hannibal and St. Joseph Railroad Company, at the recent meeting in this city, have contracted with Mr. Duff, a gentleman representing a Boston Company to build the entire road, depots, locomotives, cars and every thing complete; the work will be commenced at both ends of the route as the locations are made, probably in November, and to be finished in four years.—(*St. Joseph Adventure.*)

We see it stated in the "Brunswicker" that the work is let at $23,000 per mile. We are not informed whether or not this includes the equipments.

## LITERARY DEPARTMENT.

### Conspiracy of Pontiac.

*History of the Conspiracy of Pontiac and the War of the North American Tribes against the English Colonies after the Conquest of Canada.* By FRANCIS PARKMAN, Boston, 1851.

REVIEW BY MANN BUTLER.

[Conclusion.]

With these capacities and resentments burning in the breasts of his countrymen, Pontiac assumed the initiative in the confederacy, against the British garrison established in his country. He sent embassadors to the tribes on the "Ohio and its tributaries; they passed northward to the region of the upper lakes, and the wild borders of the river Ottawa, in Canada; and far southward towards the mouth of the Mississippi." P. 166. "Bearing with them the war belt of wampum broad and long as the importance of the message demanded; and the tomahawk stained red, in token of war; they went from camp to camp, and from village to village. The message was heard everywhere with approbation, the belt was accepted, the hatchet snatched up, and the assembled chiefs stood pledged to take part in the war. The blow was to be struck in the month of May following, to be indicated by the changes of the moon. The tribes were to rise together, each destroying the English garrison in its neighborhood; and then, with a general rush, the whole were to turn against the settlements of the frontier." These confederate tribes comprehended the Algonquins, the Wyandots, and several tribes of the lower Mississippi, and the Senecas, the only tribe of the six nations, who joined in this league. Now came council after council, till the plan of war was fully adopted. Its first feature was to surprise the garrison of Detroit, and murder its commanding officer, Major Gladwyn. Pontiac was to demand a council, so common between the Indians and the whites, upon all matters of importance. The Indian party were to carry weapons beneath their blankets, and their guns were shortened for this purpose. When Pontiac should address the commandant in the council, he was to make a certain signal, upon which the chiefs were to raise the war whoop, rush upon the officers present, and strike them down. The other Indians, waiting all night at the gate, or loitering among the houses, on hearing the yells and firing within the building, were to assail the astonished and half-armed soldiers; and thus Detroit would fall an easy prey. P. 186. Such was the conspiracy part of this great Indian combination. "It was eagerly adopted." Preliminary to this bold and daring attempt, an effort scarcely less bold was made, to reconnoiter the enemy's stronghold. On the 1st of May, 1763, Pontiac with forty or fifty of his followers came to the fort-gate, and desired to enter

for the purpose of dancing the calumet-dance before the British commander and his officers. They were admitted, and while the greater part of the party were busied in the wild dance, surrounded by the officers and men of the garrison, another portion of the Indians were examining the defences of the place, to report their condition to their great chief. This visit excited no suspicion in the minds of the British; nothing was more usual in the intercourse of the native barbarians with their foreign visitors. The month rolled on in the usual routine of a frontier fortress; while the nations of the forest were all on the alert, making ready for a great and desperate blow, which should annihilate their foreign masters. In the midst of this security, on the one part, and deep laid schemes of vengeance on the other, the fatal day advanced, when late in the evening of the 6th of May, 1763, a girl of the Ojibwa tribe, of more than ordinary Indian beauty, (called Catherine by the English) who had attracted the love of Gladwyn, "repaired to his quarters bringing with her a pair of elk-skin mocassins ornamented with porcupine work, which he had requested her to make." There was something sad and downcast about her, and after leaving Gladwyn, she was observed "still lingering at the street corner, though the hour for closing the gates had nearly come. At length she attracted the notice of Gladwyn himself; and calling her to him, he pressed her to declare, what was weighing upon her mind. Still she remained for a long time silent, and it was only after much urgency, and many promises not to betray her, that she revealed her momentous secret. To-morrow, she said, Pontiac will come to the fort with sixty of his chiefs. Each will be armed with a gun cut short, and hidden under his blanket. Pontiac will demand to hold a council; and after he has delivered his speech, he will offer a peace-belt of wampum holding it in a reversed position. The chiefs will spring up, and fire upon the officers, and the Indians in the street will fall upon the garrison. Every Englishman will be killed, but not the scalp of a single Frenchman will be touched."

Such are the interesting particulars derived by the author from the traditional account from the lips of an Indian interpreter, Henry Conner, communicated to H. R. Schoolcraft, and confirmed by Carver in his Travels. Could a vulcano burn so silently or breathe violence more fell! But before we proceed with the thrilling circumstances of this profound, well laid and diabolical conspiracy, it may be interesting to know something more about this object of Indian hate and fear, which had been planted by La Motte Cadillac for the French government, as early as 1701. P. 188.

Detroit at this time (1763) contained 2500 inhabitants, surrounded by villages of Wyandots, Pottawattamies and Ottawas, at short distances. In the centre of the settlement stood the Fort on the margin of the river Detroit, and contained about a hundred houses, compactly built together, and surrounded by a palisade

about twenty feet high. At each corner was a wooden bastion and blockhouse built over each gateway. The houses were small, chiefly built of wood, and roofed with bark or a thatch of straw. The streets were also extremely narrow, though a wide passage way, known as the *chemin du ronde*, surrounded the town between the houses and the palisade." P. 190. "The garrison consisted of a hundred and twenty soldiers, with about forty fur traders and *engagés;* but the latter, as well as the peaceful Canadian inhabitants of the place, could be little trusted, in the event of an Indian outbreak. Two small armed schooners, the *Beaver* and the *Gladwyn*, lay anchored in the stream, and several light pieces of artillery were mounted in the bastions." Such was the only hope and stronghold of the British, on this remote frontier, with no hope of reinforcement nearer than Fort Niagara and Montreal, in the heart of powerful and exasperated savages amounting, according to various accounts, from 600 to 2000 warriors. Let us see how civilized man can deal with all the arts and force of barbarian warfare under circumstances, apparently so unequal for the former, so favorable to the latter. Gladwyn, the British commandant, was now convinced of his danger, tho' he had lent a deaf ear to other and grave warnings. "Every preparation was made to meet the sudden emergency. Half the garrison were ordered under arms, and all the officers prepared to spend the night upon the ramparts." "It rained all day," writes a chronicler of the times," cleared up towards evening, and there was a very fair sunset." From sunset till dawn, an anxious watch was kept from the slender palisades of Detroit. The soldiers were still ignorant of the danger, and the sentinels did not know why their numbers were doubled, or why, with such unwonted vigilance, their officers visited their posts. Again and again, Gladwyn mounted his wooden ramparts, and looked forth in the gloom. There seemed nothing but repose and peace in the soft, moist air of the warm spring evening, with the piping of frogs along the river bank, just roused from their torpor by the genial influence of May. But at intervals, as the night wind swept across the bastion, it bore sounds of fearful portent to the ear; the sullen booming of the Indian drum, and the wild chorus of quavering yells, as the warriors around their distant camp fires, danced the war dance, in preparation for the morrow's work." P. 196. The whole passage ushering in the great final act of the dread drama, is most beautifully dramatic itself; but I must condense these charms of composition into a more brief, tho' less comely narrative.

Many Indians, with dangerous confidence were admitted, in the course of the next morning, into the fort; "they were wrapped in their blankets, stalking about, and casting malignant, furtive glances towards the palisades. At ten o'clock, the great war chief with his treacherous followers reached the fort, and the gateway was thronged with their savage faces. All were wrapped to the

throat in colored blankets. Some were with hawk, eagle, or raven plumes; others had shaved their heads, leaving only the fluttering scalp lock on the crown; while others, again, wore their long, black hair flowing loosely at their backs, or wildly hanging about their brows, like a lion's mane. Their bold, yet crafty features, their cheeks besmeared with ochre and vermillion, white lead and soot, their keen, deep set eyes, gleaming in their sockets like those of rattlesnakes, gave them an aspect grim, uncouth and horrible." "For the most part, they were tall, strong men, and all had a gait and bearing of peculiar stateliness." Could a spectator of this Indian file have given a more graphic and lively account! Yet it is a picture true to the life of an Indian procession, in full costume.

As Pontiac entered the fort-gate, he was struck with the sight of ranks of soldiers, and hedges of glittering steel. The swarthy, half wild *engagés* of the fur traders, armed to the teeth, stood in groups, at the street corners, and the measured tap of a drum fell ominously on the ear. The chief was startled, and a deep ejaculation half escaped from his breast; yet, with the composure, at the peril of life, characteristic of his race, he strode forward with his followers, to the council house. Here they found Gladwyn with several of his officers seated to receive him, every man armed to the teeth. "Why," demanded Pontiac, "do I see so many of my father's young men standing in the street with their guns?" The British officer replied, that they were under arms "for the sake of exercise and discipline." Reluctantly and tardily the chiefs took their seats on the mats prepared for them; and after some pause, Pontiac rose to speak, professing in usual Indian phrase, his attachment to the English, and "that he had come to smoke the pipe of peace, and brighten the chain of friendship." "Once, it is said, he raised the wampum belt, as if about to give the signal of attack, but at that instant, Gladwyn signed slightly with his hand. The sudden clash of arms sounded from the passage without, and a drum rolling the charge filled the council room with its stunning din." Pontiac, surprised by the calm self-collectedness of the British, soon resumed his seat, in amazement and perplexity. Gladwyn made a brief reply. He assured the chiefs, that friendship and protection should be extended towards them as long as they continued to deserve them; but threatened ample vengeance for the first act of aggression. P. 200. The council then broke up, and Pontiac told the officers that he would return in a few days with his squaws and children; for he wished that they should all shake hands with their fathers, the English.

The gates of the fort, which had been closed during the conference, were again flung open; and the baffled savages were suffered to depart, rejoiced, no doubt, to breathe the free air of the open fields. In the words of Gladwyn in a letter to Sir J. Amherst: "However, in about half an hour, after they saw that their designs

were discovered, they sat down, and Pontiac made a speech, which I answered calmly, without intimating my suspicion of their intentions; and after receiving some trifling presents, they went away to their camp." P. 201.

Yet this baffled attempt did not discourage Pontiac from trying another, to ascertain, what he felt uncertain about, whether it was the ignorance, or the cowardice of the British commander, which had let him and his warriors safe out of the lion's den; an escape, which Gen. Amherst hoped they had not made. Early in the morning of the 8th of May, Pontiac again made his appearance at the fort-gate, "with three of his chiefs, bearing in his hand the sacred calumet or pipe of peace, the bowl carved in stone, and the stem adorned with feathers. Offering it to the commandant, he addressed him and his officers to the following effect: "My fathers, evil birds have sung lies in your ear. We stand before you as friends of the English. We love them as our brothers, and to prove our love, we have come this day to smoke the pipe of peace." At his departure he presented the pipe "to Major *Campbell*, second in command, as a further pledge of his sincerity."

On the 9th of May, the wily chief made a further and better concerted plan to surprise the garrison. Indians from the four tribes thronged about the fort, and Pontiac again made application to enter the fort, which was permitted to him alone, but he was told, "that the crowd he had brought with him must remain outside." "Pontiac rejoined that he wished all his warriors to enjoy the fragrance of the friendly calumet." Gladwyn, thrown off his guard by those repeated attempts to surprise and outwit him, declared that "he would have none of his rabble in the fort." And now, the conspiracy was over, and open, savage warfare in all its fiendish orgies broke forth.

War, in the wildest form which civilized and unsavage society can imperfectly give to its horrors, is ever the most demoniac exhibition of human passions. Man slaughtering man, with all the ferocity which high skill and intrepidity can give, still arrogates the dread prerogative of the Most High, to determine life or death. But while gallantry, humanity, and honor all combine by their gentleness to alleviate the calamities of war between civilized nations; while the pardonable enthusiasm of cooperating with great bodies of men breathing the same feelings amidst "all the pomp and circumstance of glorious war," may gild these fearful conflicts of human beings. But in war with savage foes, which one of these alleviations is to be found? The march is through the gloom, the silence, and solitude of the forest, the enemy almost always under covert, and ready to spring with unsparing fury upon his victim. The garrison duty is yet harder, and more deterring; situated on the frontiers, surrounded by wilderness, beset by the same wily and ferocious foe, the men are constantly hovering on death by sur-

prise or starvation from destitution. This, then, was the situation of Detroit, on the 9th of May, 1763.

But before the result and sequel of this *one* act, the conspiracy, are succinctly sketched, the reader may be pleased to contrast a similar adventure between the late General Harrison and Tecumseh. It happened at a council held in 1810 with that chief at Vincennes, after some conference between this chief and the General about a treaty negotiated by the latter for a cession of Indian lands, and the announcement by the Indian orator "of resistance to every cession of land unless made by all the tribes, who, he contended, formed but one nation." (Drake's Life of Tecumseh, p. 125.) While the interpreter was explaining the General's speech in reply, Tecumseh in the midst of the translation, sprung from the ground to his feet, and spoke with violent gestures, declaring that all the Governor had said was false, and that he, and the seventeen fires (*i. e.* States,) had cheated and imposed upon the Indians. "At that moment the followers of Tecumseh seized their tomahawks and warclubs, and sprung on their feet, their eyes turned on the Governor." The readiness of the Governor and his friends, together with the arrival of the guard, prevented any further outrage. "Governor Harrison then told Tecumseh, that he was a bad man, and that he would hold no further communication with him; that, as he had come to Vincennes, under the protection of a council fire, he might return in safety; but that he must immediately leave the village. Here the council terminated."

There is a remarkable coincidence between the policy of Pontiac and Tecumseh. Both stretched every nerve of influence and power known by the red man, to withstand the fatal progress of the white farmer; both distinguished themselves in their patriotic efforts; and however fatal they might have been to our own race, this should not prevent our doing justice to those devoted heroes, devoted to the rescue of their own doomed race from overthrow, by a hostile one.

It would be intruding too much on the plan of this Journal, to detail all the subsequent conflicts between the Indians and the British, about Detroit alone; some times on the Lake, and at other times by land, most spiritedly related by our author. These are intermingled with sketches of scenery and manners graphic to a degree of excellence rarely equalled. As a specimen of landscape painting, this extract is selected.

"Standing on the water bastion of Detroit, the landscape that presented itself, might well remain impressed through life upon the memory. The river about half a mile wide, almost washes the foot of the stockade and either bank was lined with the white Canadian cottages. The joyous sparkling of the bright blue water; the green luxuriance of the woods; the white dwellings looking out from the foliage; and in the distance the Indian wigwams cur-

ling their smoke against the sky,—all were mingled in one great scene of wild and rural beauty." P. 191.

Again, describing the sunset before the conspiracy broke forth:

"Perhaps it was such an one, as even now, when all else is changed, may still be seen at times from the eastern shore of the Detroit. A canopy of clouds is spread across the sky, drawn up from the horizon like a curtain, as if to reveal the glory of the West, where lies a transparent sea of liquid amber immeasurably deep. The sun has set; the last glimpse of his burning disk has vanished behind the forest; but where he sank, the sky glows like a conflagration, and still, from his retreat, he bathes heaven and earth with celestial coloring. The edges of the cloudy curtain are resplendent with gold, and its dark blue drapery is touched with blood-red stains by the floods of fiery radiance. The forest and the shores melt together in rich and shadowy purple, and the waters reflect the splendor of the heavens." P. 195.

A glowing picture of a gorgeous sunset, whose fidelity to nature every one, familiar with the skies of the West, will confess. The writer's own recollections of eastern scenery do not now enable him to contrast it with that of our western region. There are few of the most indifferent observers of nature, who will not recognize this vivid picture of a western sunset.

The description of the season known as the Indian summer strikes the writer as equally beautiful.

"A light haze rests on the morning landscape, and the *many colored* woods seem wrapped in the thin drapery of a veil; when the air is mild and calm, as that of early June, and at evening the sun goes down amid a warm voluptuous beauty that may well outrival the softest tints of Italy. But through all the still and breathless afternoon, the leaves have fallen fast in the woods, like flakes of snow, and everything betokens that the last melancholy change is at hand. And in truth, on the morrow, the sky is overspread with cold and stormy clouds, and a raw, piercing wind blows angrily from the Northeast. The shivering sentinel quickens his step along the rampart, and the half naked Indian folds his tattered blanket close around him. The shriveled leaves are blown from the trees, and soon the gusts are whistling and howling amid gray, naked twigs and massy branches. Here and there, indeed the beach tree, as the wind sweeps among its rigid boughs, shakes the pale assemblage of crisp and rustling leaves. The pines and firs with their rough tops of dark evergreen, bend and moan in the wind, and the crow caws sullenly as struggling against the gusts, he flaps his black wings above the denuded woods." P. 405.

Such are some of the beautiful features interspersed with the grave narrative of the terrible and the heroic actions, which enter into this history. A rapid summary must bring this review to a close.

After sweeping, and in most instances, massacring the British garrisons at Green Bay, Michillimackinac, Sandusky, Le Boeuf and Presq' Isle, these forts were burnt to the ground. Fort Pit was sorely beleaguered until relieved by the battle so well fough at Bushy Run, by Gen. Bouquet, about twenty-five miles from th fort. But while Detroit and Fort Pitt were saved from the clutches of the Indians, which threatened to re-possess the continent, the frontiers of Virginia, New York and Pennsylvania were ravaged with the most frightful destruction.

These terrible calamities of Indian warfare may well, and with gratitude, be read by the present generation enjoying the fruits of their fathers' bravery and hardihood exerted against them.

At length the news of the peace of Paris, in 1763, was thoroughly credited by the Indians, their capacities for continued warfare were exhausted. What fear left unfinished, the policy and the management of Sir William Johnson and Col. Croghan completed, by their address and shrewdness. Even Pontiac, the master spirit of this most fearful combination of the savages of North America, was prevailed upon to attend a grand council at Oswego, in New York, in July, 1766. These hostilities were closed by a general peace.

After the termination of this memorable war, Pontiac does not re-appear until April, 1769. He visited St. Ange, at St. Louis, the commandant of the province, and an old military acquaintance of the Indian chief. After leaving the fort of St. Louis, he proceeded to the house where the late Pierre Chouteau was an inmate, and who recollected the interview most vividly to the end of his long life. The chief remained two or three days at this city, when hearing of an Indian gathering, at Cahokia, on the Illinois side of the Mississippi, he told St. Ange, "that he would go over, and see what was going forward." St. Ange tried to dissuade; "but Pontiac persisted, boasting that he was a match for the English, and had no fear for his life." He embarked in a canoe with some of his followers. At Cahokia, he was invited by his old friends, the Creoles of the village, to a feast, at which all parties drank deep. "When the carousal was over, Pontiac strode down the village street, to the woods, where he was heard to sing the medicine songs, in whose magic power he trusted as the warrant of success in all his undertakings."

While thus unmanned by liquor, an Indian of the Kaskaskia tribe, was bribed by an English trader, of the name of Williamson, jealous of the chief's influence over the French, and revengeful on account of his hostility to the British, basely to assassinate the great chief. The murderous bribe is said to have been a barrel of liquor, and the promise of a further reward. "When Pontiac entered the forest, the assassin stole close upon his track, and watching his moment, glided behind him, and buried a tomahawk in his brain."

Thus basely fell the greatest native chief of the Indian race known to our countrymen; and fearfully was his murder revenged by the bloody and relentless extermination of the Illinois tribes who had furnished and abetted the murderer.

In the meanwhile the body of the murdered chief lay upon the spot where he had fallen, until St. Ange, mindful of former friendship, sent to claim the body, and buried it with warlike honors near his fort of St. Louis.

An account of the Fort of St. Louis shall close this too protracted review.

It consisted of an irregular square, with projecting angles; it was built of stone, and went by the name of *Le Bastion*. This fort was situated precisely at the present intersection of Cherry street with Broadway, on the continuation of Third street, and lay east of the latter. There was a barbacan, or outerbuilding lying in a northeastern direction from the Bastion close to the fort-gate, and commanding the open space which stretched between the Bastion and a stone tower or Half Moon, which stood on the river bank. The actual inhabited village of St. Louis was then bounded on the north by a line running east from the fort to the river, and west by the present Third street. Not that the village was confined to the in-lots of the inhabited town, "for the commons, outlots, and common fields were," in the language of an eminent jurist, of St. Louis, "as much a part of a French or Spanish village as the Plaza."

There was another fort at the intersection of the present Walnut and Fourth streets, to which an ancient cemetery was attached. Of this, the writer was informed by Mr. Cozzens.

Which of these forts had the honor of receiving the remains of the great war-chief of the Ottawas, and the most distinguished chieftain ever known among the savages of North America, is now, perhaps, impossible to ascertain. No traditions can now be gathered here respecting this great light of the red men.

ARCTIC SEARCHING EXPEDITION.—*A Journal of a Boat-Voyage through Rupert's Land and the Arctic Sea, in search of the Discovery ships under command of Sir John Franklin, with an Appendix on the Physical Geography of North America. By Sir* John Richardson, *C. B., F. R. S. &c. &c.* New York, Harper and Brothers.

*Review by Dr. Prout.*

In this age of bookmaking it is really a pleasure to meet with a book of travels which will repay one for its perusal. Some time ago Capt. Zebulon Pike introduced a fashion which seems daily to be gaining ground, which was to give a journal of each day's travel, all the unimportant objects which paint themselves on the retina, and all

the trifling incidents which occur in a regular mode of wayfaring. This mere personal narrative of what I and Kit Carson did, or some other man Friday achieved in passing through a savage country without being scalped, may serve to give us some idea of the prowess and woodmanlike sagacity of the sons of the forest and the difficulties which often beset their paths, but will afford a meagre sum of knowledge on subjects which interest an intelligent and enquiring mind.—So far as the general fund of human knowledge is concerned, it would have been better, had such writers curbed their restless spirits, and not labored so diligently, bodily and mentally, in the production of these stale inanities.

The same remark applies with equal force to another class of tourists becoming more numerous every day; a class which by the caprices or the accidents of fortune has acquired the means of traveling amidst the classic ruins of a past age without taste to appreciate their beauties, philosophy to derive instruction from their teachings, or historical knowledge sufficient to speculate on the destinies of the descendants of those who reared them in their gorgeousness and grandeur. Mere pedants in learning, fops in literature, and Quixotes from the land of gossip,—they gabble about riding dromedaries, visiting harems, the probable length of the bashaw's tail, or of subjects of kindred and equal moment, while subjects of graver importance are seldom touched for fear of imparting dulness to their narratives, or probably more from the fear of having their shallowness detected if their balderdash penciling, and their sickly sentimentality should fall into the hands of a sensible and sober-minded reader, seeking some gleanings of wheat from the abundance of chaff which characterizes this form of literature. Riley's narrative with all its hairbreadth and wonderful escapes, its painful and sympathy awakening details, though now known to be mainly a work of fiction, is worth a whole bookstore of such productions. For it has at least the merit of awakening a lively interest in the fate of the narrator, and of gratifying, to the fullest extent, our deep yearnings for the marvelous.

The work before us is one of a different order from any of these. It is of the pen of one deeply imbued with the love of science, whose acquaintance with the institutions and civil regulations of society enables him to appreciate its wants, and define what is most important to be known in an age of progress and discovery. The habits of close observation, the cautious generalization, and the sober spirit of philosophizing, which pervades this work, together with the truthfulness of the writer in his delineations of nature, the ease and gracefulness of his style, are all calculated to impart to it an interest rarely possessed by such works, if we except from the denunciation the works of the prince of travellers, the author of Cosmos and the Aspects of Nature. It is not only a book of travels, but it is a book of facts, ascertained by patient observation, and of principles established by well defined illustrations and cautious inductions. The geologist, the botanist, the zoologist, the ethnologist, the philologist, the geographer, and others, will find in it a rich field, from which they may derive both pleasure and instruction.

The fate of Sir John Franklin is a subject which fills with fearful interest the public mind, both in Europe and this country. It is well

known that from the time of Columbus a nearer route to Cathay with its pearls and gold has been a leading object with many of the maritime powers of the old world. The British government, the last to be impressed with the advantages of discovering a nearer passage to the Indies, dispatched Sir John Franklin in May, 1845, to Cape Walker on Barrow's Straits, in west longitude 98°, with instructions to neglect all northward openings, and to use every effort to find a passage to the Pacific, to the southward or westward of that point. In the event of his not reaching Behring's Straits bay, he was to enter Wellington Straits, in the summer. Setting out with the Erebus and Terror, two stanchly built vessels, he was required to transmit intelligence of his proceedings to the Admiralty by the natives or the Hudson Bay Company, whenever an opportunity should offer, and also after passing the 65th Meridian, to throw over board daily a copper cylinder containing a paper stating the ships' position.

On the 4th of July, 1845, the Expedition reached Whale Fish Island, south of Disco, in Davis' Straits, where the transport, accompanying the Expedition, was cleared and sent back to England, and conveyed the last letters that have been received from the officers and crew of these ill-fated vessels. These ships were seen for the last time by Capt. Dannet, a commander of a whaling vessel, on the 26th of July, in latitude 74° 48′ N., longitude 66° 13′ W., moored to an iceberg, waiting for a favorable opportunity of entering or rounding the middle ice, and crossing to Lancaster Sound, distant in a direct westerly line 22 geographical miles.

No intelligence of the Expedition having been received for some eighteen months after its last appearance at this point, serious fears began to be entertained for its safety. Various suggestions were offered as to the probable course taken by Sir John Franklin, and many were the explanations proffered as to his silence or the total absence of all information in regard to his progress. After much discussion on the subject, the Lords Commissioners of the Admiralty concluded to fit out three separate expeditions to go in search of him and to relieve him and his exhausted crews if possible from their prison home among the floating icebergs and impenetrable barriers of the Arctic Sea.

One of these expeditions, under the command of Sir James Ross, was required to pursue as near as possible the same course pursued by Sir John Franklin, and to find out by sign posts and other marks left the direction of his voyage after he reached Lancaster Sound. Another expedition was sent by the way of Behring's Straits, and the third, which forms the subject of the present notice, was fitted out under the command of Sir John Richardson, which was required to reach the Arctic ocean by an overland route, from Montreal to the mouth of the McKenzie River, and then to explore the coast, from thence north of Rupert's Land to the mouth of the Copper Mine river inclusive of Wollaston and Victoria Lands. The Expedition was further required to make deposits of stores and provisions at different points on the shores of the Arctic, so as to meet the wants of the detached parties under the direction of Sir James Ross.

Leaving out the details connected with this expedition from the arrival of Dr. Richardson at Saut Ste. Marie, on the 29th April, to his reaching the Cumberland House on the Saskatchewan, on the 9th o:

June, 1848, we will refer to a few of the facts observed, and subjects discussed, with the view of showing the general tenor of this interesting work.

The geological features, and the natural history of Lake Superior, having been so well defined by Professor Agassiz, we will omit the remarks of our author though highly interesting, and limit ourselves to his observations on the country intervening between Lakes Superior and Winipeg.

"The ascent to the summit of the water-shed between Lakes Superior and Winipeg, by the Kamenistikwoya river, is made by about forty portages, in which the whole or part of a canoe's lading is carried on the men's shoulders; and a greater number occur in the descent to the Winipeg. The summit of the water-shed is an uneven, swampy, granitic country, so much intersected in every direction by lakes that the water surface considerably exceeds that of the dry land. Its mean elevation above Lake Superior is about 800 feet, and the granite knolls and sand-banks, which vary its surface, do not rise more than 150 or 200 feet beyond that general level, though their altitude above the river valleys which surround them is occasionally greater, giving the district a hilly aspect. The highest of these eminences does not overtop Thunder Mountain and some other basalt-capped promontories on Lake Superior, and had not the silurian strata, which, judging by the patches which remain, once covered the gneiss and granitic rocks nearly to their summits been removed, the country would have been almost level, and would have formed part of the rolling eastern slope of the continent, above whose plain the highest of the hills on Lake Superior scarcely rises. The summit of this water-shed of the St. Lawrence basin, commencing toward the Labrador coast, runs south 52° west, or about southwest half-west, at the distance of rather more than two hundred miles from the water course, until it comes opposite to that elbow of the line of the great lakes which Lake Erie forms; it then takes a north 51° west course, or about northwest half-west, toward the northeast end of Lake Winipeg, and onward from thence in the same direction to Coronation Gulf of the Arctic sea. The angle at which the two arms of this extensive water-shed (but no where mountain ridge) meet between Lakes Huron and Ontario is within half a point of a right one, and the character of the surface is every where the same, bearing, in the ramifications and conjunctions of its narrow valleys filled with water, no distant resemblance to the fiords of the Norway coast. Such a preponderance of fresh water coupled with the tardy melting of the ice in spring, makes a late summer, and augments the severity of the climate beyond that which is due to the northern position of the district."

This water shed of the St. Lawrence, and Hudson's Bay, extending from Lake Huron to Coronation Gulf, is an important feature in the physical structure of this continent. It forms however but a part of a more extensive and uniform system of water sheds, which mark in nearly parallel lines the general surface of the country west of the Rocky Mountains.

The North American continent may be considered as a great table land, having its western more elevated than its eastern border, from the

preponderance of the expansive power which elevated the Rocky Mountain chain from the depths of the ocean. All the surface east of this range is a more or less gradual slope characterized by extensive table lands. The Alleghanies are evidently based upon a table land; and the water shed between the tributaries of the Missouri and Saskatchawan, when extended towards the east, becomes more and more expanded into a great table land which supports the basins of the great Lakes, emptying themselves into the St. Lawrence. The line of elevation extending from Lake Huron to Coronation Gulf is but a part of this same table land, and the water shed of the St. Lawrence extending to Labrador may be considered as its extreme eastern limit. It seems as if some expansive power had been employed to elevate the continent from Lake Huron to Coronation Gulf in a line nearly parallel with the Rocky Mountain range. This line of granitic, metamorphic and plutonic rocks, which form the western shores of all the larger Lakes between Lake Superior and the Arctic ocean, affords abundant evidence of volcanic agency.

Between the Rocky Mountain chain and this almost parallel line of elevation we have a series of water sheds which correspond, in general direction, with the Alleghany range, which is evidently only a north-eastern branch of the great backbone of the continent, the Rocky Mountain chain. Considering the Alleghany range as the first and most southern water shed, we will endeavor to trace the others in regular succession. The second in the series is the Ozark range. If that portion of this chain, which has been denuded, could be restored across Illinois and Lake Michigan, it would form a continuous connexion from the Rocky Mountain chain, through the water shed of the St. Lawrence with the Eastern coast of Labrador in a line nearly parallel with the Alleghanies. The third water shed is formed by the Black Hills, which pursue a nearly northeast course and are gradually blended with the southern border of the table land, which separates the waters of the Missouri from those of the Saskatchawan. The great table land north of the head waters of the Missouri in its tendency to slope to the north and to the east, is marked with a fourth water shed, which is that which separates the waters of the Saskatchawan from those of the Peace and Athabaska rivers. This line of elevation commencing at Mt. Brown runs in a nearly northeast direction to Methy Portage (the highest in the route from Lake Superior to the mouth of the Mackenzie), and from thence between Lake Wollaston and Black Lake to join the elevated plutonic line from Lake Huron to Coronation Gulf.

A fifth water shed is that which separates the waters of the Peace and Athabaska rivers from the affluents of the Great Slave Lake. The sixth and last is the line of elevation which divides the waters of Great Slave Lake from those flowing into Bear Lake. Between Bear Lake and the Arctic ocean the spurs of the Rocky Mountain pursue the same general direction to the northeast, and become low ranges of hills rendered shorter in extent by the general contour of the continent.

We see here six prominent lines in which an elevatory force has been exercised, so as in some measure to preserve a parallelism which is truly remarkakle. We can only give a summary of our views on

this subject here, as our space is too limited to admit of more detail, But to return to our author. The following extract will explain how the Lakes which dot the surface of almost every district in this upper region, are undergoing changes which must ultimately convert them into dry land.

"The eastern coast-line of Lake Winipeg is, in general, swampy, with granite knolls rising through the soil, but not to such a height as to render the scenery hilly. The pine-forest skirts the shore at the distance of two or three miles, covering gently-rising lands, and the breadth of continuous lake-surface seems to be in process of diminution, in the following way. A bank of sand is first drifted up, in the line of a chain of rocks which may happen to lie across the mouth of an inlet or deep bay. Carices, balsam-poplars, and willows speedily take root therein, and the basin which lies behind, cut off from the parent lake, is gradually converted into a marsh by the luxuriant growth of aquatic plants. The sweet gale† next appears on its borders, and drift-wood, much of it rotten and comminuted, is thrown up on the exterior bank, together with some roots and stems of larger trees. The first spring storm covers these with sand, and, in a few weeks, the vigourous vegetation of a short but active summer binds the whole together by a net-work of the roots of bents and willows. Quantities of drift-sand pass before the high winds into the swamp behind, and, weighing down the flags and willow-branches, prepare a fit soil for succeeding crops. During the winter of this climate, all remains fixed as the summer left it, and as the next season is far advanced before the bank thaws, little of it washes back into the water, but, on the contrary, every gale blowing from the lake brings a fresh supply of sand from the shoals which are continually forming along the shore. The floods raised by melted snows cut narrow channels through the frozen beach, by which the ponds behind are drained of their superfluous waters. As the soil gradually acquires depth, the balsam-poplars and aspens overpower the willows, which, however, continue to form a line of demarkation between the lake and the encroaching forest."

In the following observations, the limit to the geographical distribution of some forms of vegetation, is defined page 50:

"With respect to the forests: The white or sweet cedar (*Cupressus thyoides*) disappears on the south side of Rainy Lake, within the American boundary line. The Weymouth pine, various maples, cockspur thorns, and the fern-leaved Comptonia, reach the southern slope of the Winipeg basin. Oaks extend to the island and narrows of that lake. The elm, ash, arbor vitæ and ash-leaved maple terminate on the banks of the Saskatchewan. The "wild rice," or *Folle avoine** of the voyagers and traders, grows abundantly in the district between Lakes Superior and Winipeg.

* *Zizania aquatica* L., or *Hydropyrum esculentum* of Link.

† *Myrica Gale*, (Sweet Willow.)

This grain resembles rice in its qualities, but has a sweeter taste. Though small, it swells much in cooking, and is nourishing, but its black husk renders it uninviting in its natural state. In favorable seasons it affords sustenance to a populous tribe of Indians, but the supply is uncertain, depending greatly on the height of the waters. In harvest time the natives row their canoes among the grass, and, bending its ears over the gunwale, thresh out the grain, which separates readily. They then lay it by for use in neatly-woven rush baskets. This grass finds its northern limit on Lake Winipeg, and it is common in the western waters of the more northern of the United States; but how far south it extends, I have not been able to learn. Strache, in his "Historie of Traveille in Virginia," speaks of a "graine called *Nuttowine*, which groweth as bents do in meadowes. The seeds are not much unlike rice, though much smaller; these they use for a deyntie bread, buttered with deere's suet." (p. 118.) It is possible that he may refer to a smaller species (*H. fluitans*) of the same genus, which is known to abound in Georgia; but the seed of that could scarcely be collected in sufficient quantity. The hop-plant (*Humulus lupulus*) reaches the south end of Lake Winipeg, and, according to Mr. Simpson, yields flowers plentifully in the Red River colony. We observed it in the autumn of 1849, growing luxuriantly on the banks of the Kamenistikwoya, and connecting the lower branches of the trees with elegant festoons of fragrant flowers. An opinion prevailed among the traders that Lord Selkirk introduced it into this neighborhood when he took possession of the Northwest Company's post of Fort William, upward of thirty years ago; but the plant is indigenous to America, and grows abundantly in the Raton Pass, lying on the 37th parallel, at the height of eight thousand feet above the sea, as well as in many localities of the northern States. Throughout the canoe-route from Lake Superior to Lake Winipeg, no district shows such fertility as the banks of Rainy River. In autumn, especially, the various maples, oaks, sumachs, ampelopsis, cornel bushes, and other trees and shrubs whose leaves before they fall assume glowing tints of orange and red, render the woodland views equal, if not superior, to the finest that I have seen elsewhere on the American continent, from Florida northward. Nor are showy asters *helianthi*, *lophanti*, *gentianeæ*, *physostegiæ*, *irides*, and many other gay flowers, wanting to complete the adornment of its banks."

On the 14th of June Dr. Richardson and his party left the Cumberland House for the mouth of the Mackenzie, by the way of the Minisippi or Churchill river, and on the 17th they reached the Second Ridge Portage, on Ridge river. This is said to be the highest point to which the sturgeon ascends, on this side of the Rocky Mountains. Two species are found here, the *Accipenser Rupertianus* and the *Nameyu* of the Crees, which had not been described. The first is small, weighing generally from 15 to 20 pounds, the latter often weighs as much as 90 pounds.

Heron or Moon Lake, Pelican and Wood Lakes, abound in many varieties of fish, and are visited by large bodies of pelicans, white-headed eagles (Haliæetus albicilla). The eagle is found throughout Rupert's Land, and the pelican ranges to 60°–61° North. The black-bellied tern ranges to the upper Mackenzie, and the Cayenne tern is met with as far as the Arctic Circle. The Grus Canadensis, or brown crane, and the Grus Americana, which our author supposes contrary to the view of Audubon, to be a distinct species, are found here in great numbers. The first is found as far as the Arctic, the other is limited to the latitude of Slave Lake. For much interesting information on the habits of these birds we must refer the reader to the work itself.

On the 24th of June, our voyager arrived at *Isle a la crosse.* The country traversed from Cumberland House to this point, was very uniform in the character of its rocks; granite in mass, and boulders, sienite, green-stone, hornblendic slates, and other pyrogenous rocks, were found both on the Ridge and Churchill rivers, throughout this entire extent. Beaver river flows over limestone strata, on the south of Isle a la crosse; and a line running from the northern shore of Lake Winipeg to the southern shore of Isle a la crosse, or north 58° west, is considered by our author as representing the line of junction of the limestone with the primitive rocks of this district of country.

Isle a la crosse is estimated as being 1300 feet above the ocean, and Carlton House, on the Saskatchewan, as 1100. This would give a descent of a little more than 2 feet to the mile to the eastern slope from these points to Hudson's Bay: the distance from the former being 525 geographical miles, in a direct line and from the latter 625 miles.

On ascending the Methy river to the Rapid of the Tombs, the northern limit of the red or pitch pine, was attained; only a few trees were found here intermixed with the black spruce. Methy Portage which separates the waters flowing into Hudson's Bay from those flowing into the Arctic by the Mackenzie river, is estimated as being 1540 feet above Clearwater river, which flows into the Mackenzie. This source of the Mackenzie is therefore only about 900 feet above the level of its mouth on the Arctic ocean.

Dr. Richardson arrived at Clear-water on the 6th of July, after being detained some six days longer than he anticipated, in crossing Methy Portage. The sand on the N. E. flank of the portage is 600 feet deep. The sandstones and limestones in the bed and on the banks of this stream he regards as belonging to the Erie division of the New-York system, or the silurian. He describes the Clear-water valley as being unsurpassed by any which he had seen in America for beauty. He says: "The view from the Cockscomb of Methy Portage extends 30 or 40 miles, and discloses, in beautiful perspective, a succession of steep, well-wooded ridges descending on each side from the lofty brows of the valley to the borders of the clear stream which meanders along the bottom. Cliffs of light-colored sand occasionally show themselves, and near the water, limestone rocks are almost every where discoverable. The *Pinus Banksiana* occupies most of the dry sandy levels; the white spruce, balsam fir, larch, poplar, and birch, are also abundant; and, among the shrubs, the *Amelanchier*, several cherries, the silver-foliaged *Eleagnus argentea*, and rusty-leaved *Hippophae Canadensis* are the most conspicuous." (To be continued.)

POEMS BY EDWARD STAGG.—St. Louis, Mo.: Published by Keith & Woods. New York: A. S. Barnes & Co. 1852.

To find a master-piece of Art is difficult; to find fault is easy. Depreciation is more fashionable than appreciation. A disposition to discover

'Sermons in stones and good in everything'

is uncommon. This disposition is as good as it is rare, and it breathes throughout these poems. It is one of the most civilizing elements in human nature, and an alleviator of its sorrows. It accumulates joy in a glad heart, and relieves the grief of the mourner. It takes the sting from death, and leads the way to victory over the grave.

We have not space to review this work at present.

The poems are short, and the subjects treated, are generally taken from ordinary life. The rhythm of kindly feeling flowing along the lines is finer than the rhyme or the rhythm of the words. The ideas are better than the expressions.

The improvement of the heart more than the amusement of the fancy, the instruction of the mind more than the allurement of the ear, the elevation of the moral sentiments more than the description of outward forms seem to have been the aim of the author.

We present a few extracts, and let them speak for themselves:

TO MINNIE S——.

* * * * * * * *

There will be much to taint thy heart
Around thee, but, O! that "good part,"
Like Mary, take;
Then shall thy days flow smooth and sweet,
Thy hours, with incense on their feet,
Shall lead to Bliss above!

FOLLOW ON!

Follow where thy duties call thee!
Follow! with unflinching tread!
Let not fear of man appal thee:
None but God thou e'er should'st dread!
Onward!
Onward!
None but God thou e'er should'st dread!

Dare to do what conscience tells thee
Is the right, the nobler part!
Scout the thought that e'er compels thee!
Drive the Traitor from thy heart!
Onward!
Onward!
Drive the Traitor from thy heart!

Bare thy bosom to the battle!
Let the storm beat on thy breast!
What though shafts around thee rattle?
Follow! trust to God the rest!
Onward!
Onward!
Follow! trust to God the rest!

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HEWITT & STEINACKER, Saddle, Harness and Trunk Manufacturers, wholesale and retail, No. 67 Fourth street, corner of Pine, opposite the Planters House, St. Louis.

## Mathematical Instruments.

J. BLATTNER, Mathematical and Surgical Instrument maker, Dealer in Guns, Pistols and Sporting Materials, No. 58 North Second street, between Pine and Olive, St. Louis, Mo., manufactures, and has always on hand: Surveyor's Compasses, Levelling Instruments, Theodolite Pocket Compasses, Spy-glasses, Barometers, Thermometers, Drawing Instruments, Spectacles, Ivory and Gunter's Scales and Protractors, Hour and Half Hour Glasses, Microscopes and Magnifying Glasses, Hydrometers of silver and glass, hydrometers for acids and salts, Magic Lanterns, Electrical Machines, &c., also, Surgical and Dental Instruments; Pocket, Dissecting, Cupping and self-injecting cases; Taylor's Shears, all sizes; Syringes, large and small, Scarificators, Lancets; Forceps; Turnkeys; large Scales and Weights for Druggists; Prescription Scales on Stands; Revolvers, Guns, Pistols, Powder Flaks, Game Bags, &c. ☞All the above Instruments repaired at short notice in the best manner.

## Hardware.

WILSON & BROTHERS, Wholesale Dealers in Hardware, corner of Main and Olive streets, St. Louis, Mo.

P. WONDERLY, Manufacturer of Copper, Tin and Sheet Iron Work—such as Copper Pipes for Steamboats and Distilleries, Soda Fountains, Copper ettles, Well and Cistern Pumps, and every other article in his line of business, No. 233 Main street, South-east corner of Cherry, St. Louis, Mo. He also manufactures and keeps constantly on hand, Premium Steamboat Cooking Stoves. Tinware always on hand, wholesale and retail.

## Furniture.

WM. M. HARLOW, proprietor of the St. Louis Furniture Store, manufactures and keeps constantly on hand every variety of household furniture, matresses, window blinds, willow ware, &c.

Also, manufactures to order every article in his line, with despatch. Orders from abroad promptly attended to, and goods carefully packed. All goods warranted as recommended.

New Warehouse, No. 88 Second street, between Olive and Locust streets, St. Louis, Mo.

## Paper Hangings.

JOHN S. WATSON, (late of Wilgus & Watson) No. 54 40' Pine street, between Second and Third, next door above the old stand of Wilgus & Watson, house, steamboat, sign and ornamental painter, grainer, glazier, whitener and paper hanger; also, dealer in all the latest styles of French and American paper hangings. He keeps constantly on hand and ready for sale mixed paints of all colors, oils, varnishes, Japan, turpentine, white lead, putty, and a large and superior assortment of French and American window glass, which will be cut to any size to suit customers.

Particular attention paid to estimating on houses or steamboats. November.

WOLF & ENGERT, importers and dealers in Paper Hangings, Colors and Fancy Papers, No. 49 South Second street, between Elm and Myrtle, St. Louis, Mo. Constantly on hand, all kinds of oil and water colors, paper-hangings, chimney screens, tester pieces, window shades, marble, marroquin, Gold and Silver paper, painters' and Dutch gold bronze, lead pencils, paint boxes, paint brushes, drawing paper, &c. April, 1850.

## Records.

PERSONS wishing to obtain transcripts of records in New Madrid county, can procure them without delay by addressing the undersigned. And to avoid the inconvenience of remitting small sums, the records will be directed to George Pegrim & Co., St. Louis, who will deliver the same upon the payment of the fees. WM. MOSELEY,
Recorder of New Madrid Co., Mo.
March, 1851.

## Fruit Trees.

FRUIT TREES AND SHRUBBERY, for sale by the undersigned, at their fruit farm and nursery. This establishment is located seven miles South of St. Louis, Mo. There are Omnibus Coaches running daily from the City within one half mile of the establishment. The Nursery and Gardens are open at all times (Sundays excepted) for the reception of visitors. Horticulturists and amateurs are respectfully invited to visit the establishment and examine for themselves. In directing the attention of the public to their nursery, they would remark that one of the firm, (Mr. James Sigerson,) has been engaged in the above business for the last twenty-five years; during that time he has tested many of the varieties now growing. This, with the assurance on their part of an intention to increase the number of their trees, as well as to add to their assortment from year to year, furnishes a strong guarantee to persons wishing to make choice selections of fruit, that they can always be supplied. Their prices for trees will be as reasonable as at any similar establishment East or West, and when desired, trees will be delivered free of charge in the city or on steamboats; packed in good order for their destination.

☞All letters addressed to John Sigerson, St. Louis, or to James Sigerson, Carondelet, will meet with prompt attention.

JOHN SIGERSON & BROTHERS.

## Commissions.

H. W. LEFFINGWELL, Notary Public — R. S. ELLIOTT, Com'r of Deeds.

LEFFINGWELL & ELLIOT, Real Estate Dealers, Auctioneers and Conveyancers, No. 123 Chestnut street, St. Louis, Mo. Real Estate sold on commission, at private sale, or auction. Also, deeds of all kinds written, and acknowledgments taken. Maps of the city and additions to be seen at the office, and information given free of charge. Surveying done promptly and correctly.

GENERAL AGENCY at Dubuque, Iowa, for public lands, real estate, military land warrants, payment of taxes, investigation of titles, amicable collection of debts, and all other business within the legitimate sphere of an Agent's duties, by

CHARLES CORKERY,

Notary Public and Commissioner of Deeds and Depositions for all the North-western States, Missouri included. October, '51.

## Foundry.

ROLIN CLARK, JOHN RENFREW. — PHILANDER BRALEY. ALEXANDER CROSIER.

EAGLE FOUNDRY AND ENGINE SHOP, North-west corner of Main and Biddle streets. Manufacturers of all kinds of machinery, boilers and sheet iron work, portable circular saw mills always on hand, all orders executed with fidelity and despatch.

## Horse Shoeing.

JOHN MULLERY, Premium Horse Shoer in the alley, opposite the Post Office, will as usual pay particular attention to the various diseases affecting the feet of horses, and will guarantee to give general satisfaction in either of the above departments.

## Washington Steam Sash Factory.

**B. PHILIBERT,**

WASHINGTON Avenue and 14th street, south side St. Louis, Mo., makes Doors, Sash and Blinds Also, Door and Window Frames. Terms moderat N. B.—Slitting and Planing done here.

## Lithographic Establishment.

SCHAERFF & BRO., No. 71 Market street, St. Louis, Mo., are prepared to execute anything in the line of lithography; and especially, as they are in possession of the largest sized lithographic presses and stones, they are able to fill orders of the largest dimensions. They take and lithograph portraits and likenesses from daguerrotypes, engrave or lithograph show bill cards, business and visiting cards, diplomas, music, manifests, labels, facsimiles, bank notes, bank bills, bank checks, bill heads, drafts, bills of lading, maps, town plats, &c.

☞They particularly beg leave to request the special notice of the public to their crayon drawings and colored lithographs, in as much as this is the only establishment in the West, where this improved style of lithographing is practiced.

## Boots & Shoes.

JOHN HOW. ROBT. COOK. — WM. CLAFLIN. JNO. A. ALLEN.

HOW, CLAFLIN & COOK, dealers in boots and shoes, hides, leather, shoemakers' findings, Tanners' oil, Curriers' tools, &c., 412 Main street, (opposite the Bank,) St. Louis, Mo. April, 1851.

## Safes.

M'MURRAY & DORMAN, Iron Railing Manufactory, n. s. of Chesn. bet. 9. & 10. streets, continue to manufacture at the above establishment, all kinds of plain and ornamental iron railing, balconies, bank and jail doors, book safes, fire-vaults, iron window shutters, iron awnings, lightning rods, bedsteads, gratings, and in fact, any thing which can be formed of iron.

## Land Agency Notice.

WORTHINGTON G. SNETHEN continues to practice Law in the Supreme Court; to attend to cases before Congress; to prosecute Claims and settle accounts against the Departments and Boards of Commissioners; to procure Patents at home and abroad; to obtain Pensions and Bounty lands; to collect debts, dividends, legacies and inheritances in any part of the United States and in *foreign countries*; to make investments of funds in Loans and Stocks and on Bonds and Mortgage, and to negociate the purchase and sale of Loans Land and Patent-rights in any State of the Union. Particular attention paid to California Land Title cases coming up to the U. S. Supreme Court on appeal.

☞Communications *prepaid*. addressed to W. G. SNETHEN, 5, Carrol Place, Capitol Hill, Washington, D. C., will meet with prompt attention.

## TO THE LADIES.

MR. P. A. PIGNERO begs to inform the public, and the Ladies more particularly, that he has taken the store, corner of Fine & Fourth streets, under Planters' House, to which he will remove his establishment for False Hair, of every variety, and for Pomatums, Combs, &c. &c. Mr. Pignero has recently received from the East a large and select lot of Wigs, Cues, and False Hair, manufactured in every style and to suit every taste. He begs for an examination of his stock. Private rooms for ladies and gentlemen, entirely seperate, and fitted up, where consultation on diseases of the hair can be had free of charge.

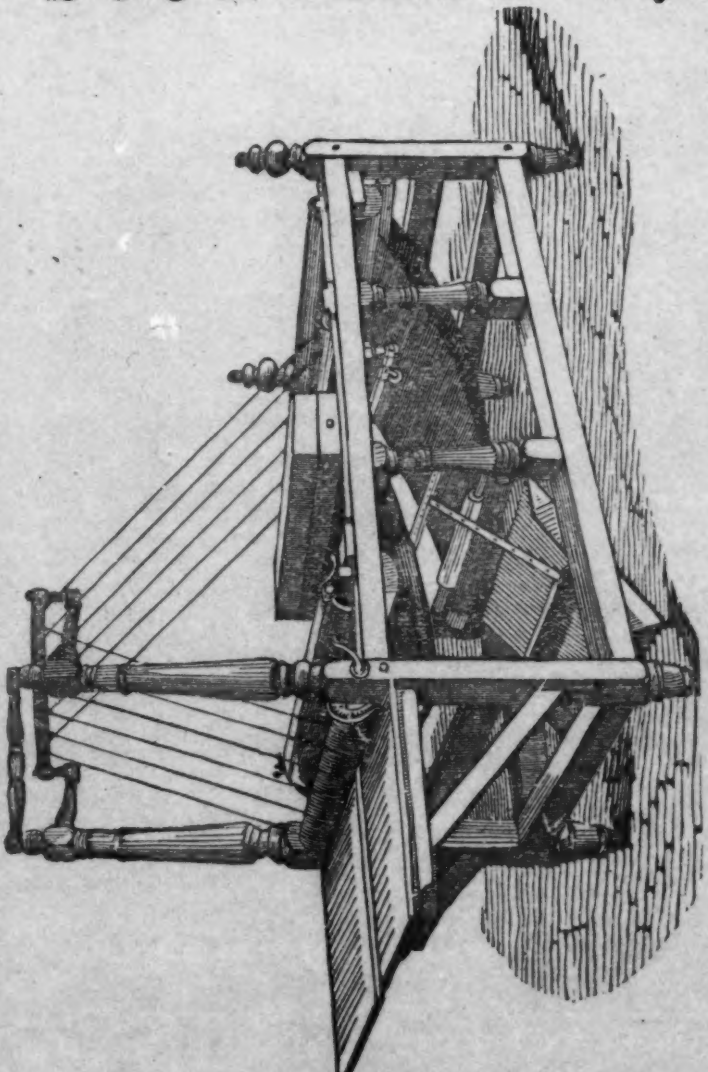
## Books & Stationery.

NORMAN'S, 14 Camp street, New Orleans, La. Books and Stationery, cheap Publications, Magazines &c., rich fancy Goods. Prices and qualities to meet your approval.

☞ Orders solicited.

# E. F. DIETZ,

# BOOK-BINDER,



## BLANK BOOK MANUFACTURER,

## AND BOX MAKER,

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The development of the vast resources of the valley of the Mississippi, and the improvement of the intellectual and social condition of its inhabitants, will be constantly kept in view; and the leading article of each number will be devoted to the advancement of these objects. In attempting to illustrate and give direction to the economy connected with the leading pursuits of the country, the Editors have undertaken more than has been done, or proposed by any other journal with which they are acquainted.

☞ Owing to the enlargement of the work, six numbers will hereafter constitute a volume, and a general Index will be made out to accompany the 6th and 12th numbers.

☞ Publishers of Newspapers who will insert the foregoing prospectus in their papers, once in three months, will be furnished with the work for one year.